PHILIPS

DATA HANDBOOK

PHILIPS ELECTRONIC COMPONENTS AND MATERIALS

ELECTRON TUBES

PART 9 JANUARY 1971

Transmitting tubes for communication and Tubes for R.F. heating

TRIODES

Associated accessories

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ELECTRON TUBES

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T.H. EINDHOVEN

Part 9 **January 1971**

General section

Transmitting tubes for communication
and Tubes for R.F. heating

TRIODES

Associated accessories

DATA HANDBOOK SYSTEM

To provide you with a comprehensive source of information on electronic components, subassemblies and materials, our Data Handbook System is made up of three series of handbooks, each comprising several parts.
The three series, identified by the colours noted, are:

ELECTRON TUBES (9 parts)	BLUE
SEMICONDUCTORS AND INTEGRATED CIRCUITS (5 parts)	RED
COMPONENTS AND MATERIALS (5 parts)	GREEN

The several parts contain all pertinent data available at the time of publication, and each is revised and reissued annually; the contents of each series are summarized on the following pages.
We have made every effort to ensure that each series is as accurate, comprehensive and up-to-date as possible, and we hope you will find it to be a valuable source of reference. You will understand that we can not guarantee that all products listed in any one edition of the handbook will remain available, or that their specifications will not be changed, before the next edition is published. If you need confirmation that the published data about any of our products are the latest available, may we ask that you contact our representative. He is at your service and will be glad to answer your inquiries.

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Part 3 High frequency; Switching November 1970

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  FC family; extended temperature range
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Part 5 Memory Products, Magnetic Heads, Quartz Crystals, Microwave Devices, Variable Transformers, Electro-mechanical Components — June 1970

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General section

List of symbols

General operational recommendations

Bases

TRANSMITTING TUBES FOR COMMUNICATION
TUBES FOR R.F. HEATING
LIST OF SYMBOLS

1. Symbols denoting electrodes and electrode connections

Anode	a
Beam plates	bp
Filament or heater	f
Filament or heater tap or star point of three star connected filaments	f_c
Grid	g
Tube pin which must not be connected externally	i.c.
Cathode	k
External conductive coating	m
Internal shield	s

Remarks

a. Similar electrodes of the same electrode system are distinguished by means of an additional numeral; the electrode nearest to the cathode has the smallest number. Example: with pentodes g_1, g_2, g_3.

b. Equivalent electrodes of a multi-unit tube are distinguished by means of an apostrophe; e.g. the anodes of a double tetrode are indicated by a and a'.

2. Symbols denoting voltages

Remarks

a. In the case of indirectly heated tubes the voltages on the various electrodes are with respect to the cathode, in the case of d.c. fed, directly heated tubes with respect to the negative side of the filament, and in the case of a.c. fed, directly heated tubes with respect to the electrical centre of the filament, unless otherwise stated.

b. The symbols quoted below represent the average values of the concerning voltages, unless otherwise stated.

Anode voltage	V_a
Anode a.c. voltage	$V_{a\sim}$
Anode voltage in cut-off or cold condition	V_{a_o}
Supply voltage of tube electrodes	V_b

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2. Symbols denoting voltages (continued)

Filament or heater voltage	V_f
Grid voltage	V_g
Grid a.c. voltage	$V_{g\sim}$
A.C. input voltage	V_i
Voltage between heater and cathode	V_{kf}
Peak value of a voltage	V_p
RMS value of a voltage	V_{RMS}
Secondary transformer voltage	V_{tr}

3. Symbols denoting currents

Remarks

a. The positive electrical current is directed opposite to the direction of the electron current.

b. The symbols quoted below represent the average values of the concerning currents, unless otherwise stated.

Anode current	I_a
Filament or heater current	I_f
Grid current	I_g
Cathode current	I_k
Peak value of a current	I_p
RMS value of a current	I_{RMS}
Saturation current	I_{sat}

4. Symbols denoting powers

Anode dissipation	W_a
Driver output power	W_{dr}
Grid dissipation	W_g
Input power	W_i
Anode supply d.c. power	W_{i_a}
Output power in the load	W_{load}
Modulation power	W_{mod}
Tube output power	W_o
Peak envelope output power	W_{oPEP}
Oscillator output power	W_{osc}

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5. Symbols denoting capacitances

In general the published capacitance values refer to the cold tube

Capacitance between the anode and all other elements except the control grid	C_a
Capacitance between anode and filament (all other elements being earthed)	C_{af}
Capacitance between anode and grid (all other elements being earthed)	C_{ag}
Capacitance between anode and cathode (all other elements not connected to the cathode being earthed)	C_{ak}
Capacitance between grid and filament (all other elements being earthed)	C_{gf}
Capacitance between control grid and all other elements except anode	C_g
Capacitance between two grids (all other elements being earthed)	$C_{g_1g_2}$
Capacitance between grid and cathode (all other elements not connected to the cathode being earthed)	C_{gk}
Input capacitance of a push-pull circuit	C_i
Capacitance between cathode and all other elements	C_k
Output capacitance of a push-pull circuit	C_o

6. Symbols denoting resistances

External a.c. resistance in an anode lead or matching resistance	$R_{a\sim}$
Matching resistance of a push-pull amplifier (anode to anode)	$R_{aa\sim}$
Filament or heater resistance	R_f
Filament or heater resistance in cold condition	R_{fo}
External resistor in a grid lead	R_g
External resistor in a cathode lead	R_k

7. Symbols denoting various quantities

Bandwidth	B
Harmonic distortion factor	d
n-th harmonic distortion	d_n
Total harmonic distortion	d_{tot}

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7. Symbols denoting various quantities (continued)

Intermodulation distortion	d_i
n-th order intermodulation distortion	d_{in}
Frequency	f
Pulse repetition rate	f_{imp}
Height above sea level	h
Modulation factor	m
Pressure drop of cooling air or cooling water	p_i
Required flow of cooling air or cooling water	q
Thermal resistance	R_{th}
Mutual conductance	S
Temperature of anode or anode block	t_a
Ambient temperature	t_{amb}
Bulb temperature	t_{bulb}
Cathode heating time	T_h
Inlet temperature of cooling air or cooling water	t_i
Pulse duration	T_{imp}
Outlet temperature of cooling air or cooling water	t_o
Seal temperature	t_s
Waiting time (= time which has to pass between switching on of the filament or heater voltage and switching on of the other voltages)	T_w
Duty factor	δ
Efficiency	η
Wavelength	λ
Amplification factor	μ
Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$

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GENERAL OPERATIONAL RECOMMENDATIONS TRANSMITTING TUBES FOR COMMUNICATION TUBES FOR R.F. HEATING

1. GENERAL

1.1 In this handbook section data and curves are given for transmitting tubes and tubes for R.F. heating.

1.2 The tubes are classified into three groups

Preferred types	– to be considered when designing new equipment
Maintenance types	– still in production but to be avoided when designing new equipment.
Obsolescent types	– will be supplied until present stocks are exhausted.

Full details are given of preferred types. Data on maintenance and obsolescent types is given in condensed form.

2. CHARACTERISTIC DATA

2.1 The characteristic data given in the data sheets is general and independent of specific application. This data (e.g. filament/heater current, amplification factor, transconductance, capacitances etc.) is applicable to a typical tube and deviations from the stated values are likely to occur in practice.

2.2 Filament/heater supply

The published value of filament/heater voltage is generally that which should be present directly at the tube terminals. Filaments fed with direct current should have their supply polarity reversed at regular intervals (say monthly), to ensure uniform wear of the filament with consequent longer life.
Reduction of filament voltage is sometimes recommended to compensate e.g. the heating by back-bombardment at high frequencies; see the relevant data sheets.
Special precautions must be taken when operating the filaments/heaters of transmitting tubes in series and the manufacturer should be consulted before doing so.

2.2.1 Pure tungsten cathodes (filaments)

The published value of filament voltage is the maximum voltage required for a new tube to supply the rated output power. A lower voltage (giving longer life) will often suffice and every tube with a pure tungsten cathode is supplied together with a list stating the saturation current at various filament voltages. Thus, knowing the required emission current, the most suitable filament voltage can be selected. Alternatively the filament voltage can be adjusted until the required output power, or maximum permissible distortion, is reached and, (to obtain peak output power) further adjusted after modulation is applied. Regular adjustment (say monthly) will be necessary to maintain the required conditions and, towards the end of tube life, the filament voltage may be raised above the nominal.

To compensate for mains supply fluctuations, automatic or manual control of the filament voltage should be exercised, especially when operating at nominal, or higher than nominal, filament voltage.

2.2.2 Thoriated tungsten cathodes (filaments)

The maximum working life from these cathodes is obtained when the filament voltage is held within 1% of the nominal. Underheating and overheating may be harmful so temporary deviations from the nominal voltage must not exceed ± 5%, unless otherwise specified.

2.2.3 Quick heating cathodes (filaments)

In general, tubes with quick heating cathodes should have their filaments in parallel only. When a sinusoidal voltage is used for heating the filament, the frequency must not be in the range 200 Hz to 5000 Hz.

When a non-sinusoidal voltage from a d.c.-a.c. converter is used the r.m.s. value should be adjusted to the published value of filament voltage.

If required the heating time can be further reduced by applying a higher value for a short time. The manufacturer should be consulted before doing so.

2.2.4 Indirectly heated oxide coated cathodes

For maximum life the heater voltage should be as near as possible to the nominal value and the maximum permissible deviation must not exceed 10%, unless otherwise specified.

R.F. voltages between heater and cathode may induce faulty r.f. insulation with resultant r.f. power losses. To overcome these losses an increase in the driving power would be required resulting in an increase of cathode temperature with a consequent reduction of tube life. Such r.f. voltages should therefore be avoided e.g. by using one of the following techniques:

- by-passing the heater to cathode insulation and decoupling the heater at v.h.f. and u.h.f.
- r.f. blocking with series chokes in heater supply leads and decoupling with capacitors.

2.2.5 Switching on the filament voltage

Unless a maximum switch-on value of filament current is stated in the data sheet, switching on at full filament voltage is permissible. The published values of the maximum permissible filament current during switch on, refer to the absolute maximum of the instantaneous value under worst case conditions. With a.c. feed this will exist when switching on at the instantaneous peak voltage of the highest mains voltage that may occur. In practice the filament current during switching on can be limited by means of a filament transformer with high magnetic leakage or a series choke or resistor in the primary of the transformer. If necessary this choke or resistor may be short circuited by means of a relay after a delay of, say, 15 seconds.

2.2.6 By-passing the filament

Tubes with directly heated cathodes must have the filament terminals at the same r.f. potential. For this purpose it is usual to connect a capacitor, that has low reactance with respect to the operating frequency, near to and between the filament terminals. As an added safety precaution it should be established that the resonance of this capacitor together with the inductance of the filament structure falls well below the operating frequency.

2.3 Switching on of the electrode voltages

Unless prescribed otherwise simultaneous switching on of filament, anode, control-grid, and screen-grid voltages is permissible for tubes with an internal anode. Tubes with an external anode should in general not have their positive voltages applied until the cathode has reached its operating temperature. This can be checked by monitoring the filament current.

2.4 Anode return

If the filament is fed with d.c. the anode return lead should be connected to the negative end of the filament. If the filament is fed with a.c. the anode return lead should be connected to the transformer mid-tap or to a tapped resistor shunted across the filament.

2.5 Inter-electrode capacitances

The published values of capacitances are average values measured on the cold tube with no operating voltages; individual deviations may however occur.
The definitions of the capacitance symbols are given in the appropriate list in I.E.C. Publication 100.

2.6 Amplification factor μ and transconductance S

The published values are average values and individual deviations may occur. Normally the conditions at which the values have been measured, are stated.

2.7 Saturation current I_{sat}

Each large tube with a pure tungsten cathode is marked with the value of filament voltage at which the saturation current has the value specified in the data sheet.

2.8 Accessories

Proper functioning of the tubes can be guaranteed only if accessories (sockets, cooling devices etc.) have been supplied, or approved, by the tube manufacturer.

3. LIMITING VALUES

3.1 Limiting values mean the maximum, or minimum, permissible values of the parameters listed. These limits are given either for all operating conditions together, or for a particular application.

3.2 The limiting values are applicable up to the maximum frequency stated. When operating at higher frequencies the limiting values must be decreased in accordance with the published data or curves.

3.3 Derating the limiting values

If no limiting values have been published for a specific application the derating factors listed in the following table must be applied. The values for class C telegraphy have been expressed as unity; the limiting values for other applications have been expressed as a factor of this unity.
A rectified 3-phase supply with or without filtering is equivalent to a d.c. supply.
The derating factors are determined by the physical limits of the tube and contain no safety margins. Where mains voltage fluctuations occur further derating must be applied (see section 3.5). The nature of operation, e.g. the industrial application of heating generators may necessitate further safety derating (see section 5.4).

Wo = tungsten filament

Th = thoriated tungsten filament

		V_a	I_a	I_g	W_{ia}	W_a	W_{g2}
R.F. class C telegraphy		1	1	1	1	1	1
Anode mod.	Th	0.8	0.833	1	0.67	0.67	0.67
	Wo	0.8	0.5	1	0.4	0.4	0.4
R.F. class B	Th	1	0.833	1	0.833 [1]	1	0.67
	Wo	1	0.5	1	0.5	1	0.5
A.F. class B		1	1	1	1	1	1
A.F. class AB		1	1	1	1	1	1
A.F. class A		1	1		W_a	1	1
Self-rectifying oscillator	Th	1.13	0.53	0.53	0.665	1	
	Wo	1.13	0.32	0.32	0.4	1	
Two-phase half-wave without filter	Th	0.9	0.89	0.89	1	1	
	Wo	0.9	0.6	0.6	1	1	

[1] or 1.5 W_a.

3.4 Rating system

The limiting values should be used in accordance with the "Absolute maximum rating system" as defined by I.E.C. Publication 134.

3.5 Absolute maximum rating system

Absolute maximum ratings are limiting values of operating and environmental conditions applicable to any electronic device of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking no responsibility for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the device under consideration and of all other electronic devices in the equipment.

The equipment manufacturer should design so that, initially and throughout life, no absolute maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply voltage variation, equipment components variation, equipment control adjustment, load variations, signal variation, environmental conditions, and variations in characteristics of the device under consideration and of all other electronic devices in the equipment.

3.6 Each limiting value should be regarded independently of other values; under no circumstances is any limiting value to be exceeded (e.g. if the anode voltage is decreased to a value lower than its limiting value, it is not permissible to exceed the limiting value of anode current or anode dissipation). Unless otherwise stated, the limiting values for currents and voltages are measured with a moving coil instrument.

3.7 Electrode voltages

The voltages (V_a, V_{g1}, V_{g2} etc.) listed under limiting values should not be exceeded even with a cold tube. Special attention should be paid to this point when a screen-grid is supplied via a series resistor.

When designing equipment to be supplied from non-stabilized mains, the maximum mains voltage occurring determines the nominal operating voltages of the tube. These nominal voltages must be lower than the limiting values. Should the transmitting tubes, and thus the voltage supply, be temporarily under a lower load their voltages will increase and these increased values, occurring at the highest mains voltage, determine the nominal operating voltages.

The limiting values of voltage are d.c. values. If an a.c. or an unsmoothed d.c. supply is used, the limiting values must be decreased in accordance with the derating factors shown in the table (section 3.3).

3.8 Anode dissipation

The limiting value of the anode dissipation W_a should not be exceeded when mains voltage fluctuations occur, or when grid drive fails. To prevent damage to the tube, in the latter case, adequate fixed bias or a quick action relay in the anode lead should be provided. When forced-air or water-cooling is sufficient only for an anode dissipation smaller than the absolute maximum, the smaller value must be regarded as the limiting value.

3.9 Anode input power

Usually the data sheets show the limiting value of input power W_{i_a} to be smaller than the product of limiting values of anode voltage and anode current; the latter two limits should not therefore occur simultaneously.

In practice the input power W_{i_a} is not always the product of the d.c. values of I_a and V_a. For pulsating supply voltages the form factor should be taken into account.

3.10 For the screen-grid dissipation the product of screen-grid voltage and current can always be taken.
The screen-grid should be protected against failure of anode voltage.

3.11 Control-grid dissipation

The control-grid dissipation W_g or W_{g1} can be approximated, by taking the power supplied to the grid bias source ($-V_g \times I_g$) from the grid driving power (approx. $0.95 \times V_{gp} \times I_g$). When an a.c., or unsmoothed d.c., voltage supply is used the form factor should be taken into account.

3.12 Grid resistance

By the maximum permissible grid resistance R_g is meant the d.c. resistance in the grid circuit. A higher value may cause instability.

4. OPERATING CONDITIONS

4.1 General

In the published data, operating conditions for various applications have been given, stating the maximum frequency at which the conditions apply. If it is required to operate a tube at higher frequencies the manufacturer should be consulted. The published values of operating conditions are average values derived from measurements made on nominal tubes working under optimum conditions. Thus, small deviations from the published value can occur if measurements are made on a particular tube. However some of the measured values of voltage or current must be adjusted to give the published figure. As an example, the published value of output power is an average value which can be reached in practice by adjusting e.g. the r.f. or a.f. input voltage V_{gp}, when the published value of output power is not obtained at the nominal value of V_{gp}. When designing a multi-stage transmitter it is good practice to leave a margin in the output power and input voltage to allow for adjustments similar to that just described. The published output power W_o of transmitting tubes is the tube output, which means the anode dissipation W_a taken from the anode input W_{ia}. When a tube is used in a common grid circuit (grounded grid circuit), the published value of the output power includes the power transferred from the input.
Unless otherwise stated losses in the anode circuit and coupling losses are not taken into account.
The quoted grid input power is assumed to be $0.9 \times$ the product of the average grid current I_g and the peak value of the grid voltage V_{gp}. Losses in the grid circuit and the bleeder are sometimes accounted for by stating the required driver output power.
At high frequencies where reduced ratings have to be applied, the required driving power will often be considerably higher than the grid input power, and in some cases, may be determined almost exclusively by circuit losses.

4.2 R.F. class C telegraphy and F.M. telephony

A class C amplifier or oscillator is one in which the grid bias is appreciably

greater than the cut-off voltage so that anode current flows for less than one half of each cycle of the alternating grid voltage. Working to the values published in the data sheets will ensure good output power and efficiency.
If a grid resistor is used for obtaining automatic bias, care must be taken that the anode current does not become too high if the r.f. driving power should fail. A safety device in the anode or screen-grid lead should be incorporated for this purpose.

4.3 R.F. class C anode and screen-grid modulation

In an r.f. class C anode modulated stage the anode voltage is modulated with a.f., and at 100% modulation the voltage is varied from zero to twice the d.c. value. With tetrodes or pentodes the screen-grid should also be modulated to prevent it being overloaded. The average values of the grid bias and r.f. driving voltage remain constant during modulation. With 100% modulation the average anode dissipation is 1.5 times the value without modulation and this is taken into account although the published limiting value of anode dissipation refers to the unmodulated power. Automatic grid bias by means of a grid leak can be used, but, to obtain minimum distortion, some fixed bias is recommended.
The modulation power published is the power required by the modulated r.f. stage. When the modulating stage is being calculated 5% to 10% must be added to allow for losses in transformer and choke.

4.4 R.F. class B telephony

A class B amplifier is one in which the grid is biased to the cut-off voltage so that anode current flows for approximately one half of each cycle of the alternating grid voltage. The published data for r.f. class B telephony has been determined, by trial and error, to give a straight modulation characteristic.

4.5 R.F. class AB SSB amplifier

The given operating conditions are from measurements made in a circuit without feedback and with constant screen-grid voltage. They show the best compromise between output power and linearity. Linearity is measured with a double tone test signal in which the two tones have equal amplitude and lie 1000 Hz apart in frequency. The amplitudes of the distortion products d_3 and d_5 are in dB referred to the amplitude of either of the two equal tones. The published values of d_3 and d_5 are the worst encountered at any driving level and occur usually slightly below full output power. Distortion products of orders other than d_3 and d_5 are in general, negligible. If the amplitudes of the distortion products are referred to the peak envelope amplitude, the figures for d_3 and d_5 go down 6 dB.

4.6 A.F. class B amplifier

With this amplifier the anode dissipation is dependent on the input signal voltage so that maximum anode dissipation is obtained when the signal is about 60% of the value at full drive. When this is not present continuously, as is the case with broadcast and telephony services, it is permissible for the limiting value of

anode dissipation to be exceeded by 10%.
To suppress even harmonics, separate controllable grid bias for each tube, or a balancing circuit, should be incorporated. This data is purely arbitrary, i.e. the same output can be obtained with less modulation of the anode current (with smaller load resistance and lower peak grid current) although the efficiency would be lower. The requirements of the complete a.f. amplifier determines which kind of operation is preferred.

4.7 Industrial operating conditions

Section 5.4 gives some general information on the application of power tubes in industrial apparatus. With a single phase mains connection a hum filter will sometimes be omitted as is normal in three phase mains connection. Operating conditions and derating factors are given for this kind of operation (section 3.3). It must be ensured that no limiting values are exceeded because of fluctuations in the mains supply or by tolerances in other components. The published value of W_o is the actual tube output power. The output power of a self-oscillating circuit W_{osc} is obtained by deducting the grid dissipation W_g and the losses in the grid resistor W_{Rg} from the output power W_o, The power in the load W_l is obtained by deducting the losses in the output circuit from W_{osc}. A favourable load output characteristic may be obtained by automatically controlling the grid voltage and current, depending on the matching. A non-linear device e.g. a tungsten lamp or an P.T.C. resistor may perform this function adequately and help to prevent overloading the grid.
With self oscillating circuits the frequency must be held within the available frequency band. This may be done by having large circuit capacitance, small stable self inductance, undercritical inductive coupling with the output circuit, electrostatic screening between oscillator and output circuit etc.
If the frequency of an industrial oscillator has to be limited to a narrow frequency band, crystal controlled driving stages may be used, then however, it is rather difficult to obtain matching between the tube input and output. A greater safety margin in the tube will be necessary with the output still depending on the load, or special measures, such as automatic tuning and/or matching control, will have to be taken.
For smaller tubes in industrial applications operating conditions have been given for when power is supplied from a single phase full-wave rectifier, a three phase half-wave rectifier (which is nearly equivalent to d.c.) and with raw a.c. In the latter case the output is about 0.6 times that obtained with d.c. and the peak inverse voltage is equal to the full anode voltage (this is of special importance as the grid voltage is in anti-phase to the anode voltage). With a single-phase, half-wave rectified anode voltage the useful output is nearly equal to that with a d.c. supply. To obtain the most favourable mains loading when using a self rectifying oscillator, a quasi push-pull circuit can be used, in which two tubes function alternately on each half wave. The best mains loading for three-phase, self rectification is obtained by using 6 tubes in a triple push-pull circuit.

4.8 Intermittent service

When data concerning intermittent service is published it is conditional that, although the cathode may be heated continuously, the on-period is no more than 5 minutes and that the off-period is equally long or longer.

5. APPLICATION OF THE OPERATING CONDITIONS

5.1 General

It is not always possible to operate the tube under the specified operating conditions. In some applications deviations from the published values are likely to occur causing the limiting values to be exceeded. Depending on the kind of service the following classification can be made:

- Fixed transmitters for broadcasting and telecommunication service, operated by a trained staff. (5.2)
- Mobile transmitters. (5.3)
- Equipment for industrial applications (r.f. heating, supersonics etc.) (5.4)
- Amateur transmitters and special applications. (5.5)
- Pulse operated equipment. (5.6)

5.2 Fixed transmitters

With fixed transmitters it is usually possible to use the tubes under ideal working conditions viz.

- only very small mains voltage deviations as the supply is derived from a special high tension line.
- stabilized mains voltage supply.
- a fairly constant and optimum transmitter load.
- the presence of safety devices which prevent tube damage under any circumstances.
- the presence of a well trained staff for the immediate repair of faults.

and thus it is permissible to operate near the limiting values.

5.3 Mobile transmitters

Mobile transmitters are transmitters which can be operated whilst mobile; they often have to function with widely varying supply voltages and with loads that are neither constant nor optimum. Safety devices are usually poor, especially in small transmitters, so the use of the tube at the published maximum operating conditions is not recommended. The actual operating conditions chosen will depend upon specific circumstances. Because the electrode system in the smaller quick heating or oxide coated transmitting tubes is rugged and can withstand the vibration and occasional shocks experienced in normally used road vehicles the tubes are ideal for mobile transmitters.

However in aircraft and vehicles used over rough ground it is advisable to shockmount the tubes. The oxide coated cathode is fairly insensitive to heater voltage variation and the high specific emission allows lower anode voltages to be used. Generally, when used in any apparatus that is likely to be subjected to shocks or vibration, tubes with thoriated tungsten cathodes require shock damping. If a special device is used to clamp a tube into its socket it must be ensured that the maximum permissible temperature is not exceeded in any part of the envelope.

5.4 Industrial application, r.f. heating, supersonics etc.

For the following reasons, in industrial equipment the tube seldom operates under ideal conditions.

- Large, uncompensated mains voltage fluctuations.
- Voltage supply with no provision against hum.
- Variable load.
- Relative large tolerances on the stability of the operating frequency.
- Intermittent service.
- Service personnel often untrained in the servicing of the electronic power equipment.

Thus the design of industrial equipment differs from that of fixed transmitters and generally demands the use of self oscillating triodes. The most reliable operation of the tube, and hence the equipment, is obtained by selecting a nominal supply potential which, at the maximum mains voltage, does not exceed the limiting value.
In equipment powered by a.c. or unsmoothed d.c., the pulsating waveform is such that the average values of voltage and current chosen must be lower than if they were supplied by a normal d.c. supply.
Special attention should be paid to the grid current and dissipation since, in most cases, they are critical values.
Special cases of intermittent service make it possible to increase the limiting values and information on these possibilities will be supplied on request.

5.4.1 Multiple tube operation

Since industrial generators are largely self oscillating, single tube operation is generally preferred. This mode of operation minimizes the risk of interaction between the tube and circuit stray reactances that could lead to parasitic oscillations. Whenever, for various reasons, such as the suppression of the even harmonics or the need for higher power at higher frequencies, push-pull or parallel operation is chosen, increased attention must be paid to the prevention of interaction between the tubes, be they in push-pull or parallel, through their connections or other stray circuit reactances.

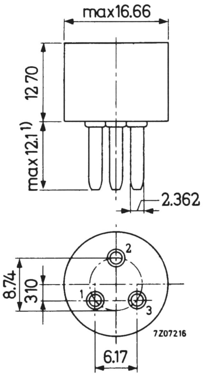
5.5 Amateur transmitters and special adjustments

The maximum permissible load of a tube is determined by the physical maxima of the tube incorporated in the limiting values. No guaranteed tube life can be given if the limiting values are exceeded although this does not imply that exceeding the limits will always result in an immediate breakdown of the tube. In the case of I.C.A.S. (Intermittent Commercial and Amateur Service) for instance, higher operating conditions have been given (see section 4.8) but generally no guarantee of tube life is given. Information about special circuits, adjustments and operating conditions will be supplied on request.

5.6 Pulsed operation

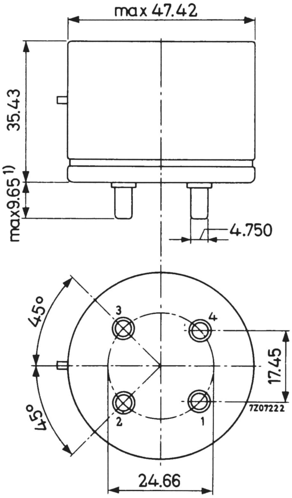
When a tube is used under pulsed operation the pulse duration must be so short that no part of the tube reaches an abnormally high temperature and flash-overs do not develop. In general the average load will be considerably less than the maximum limiting load value.
General information on this kind of information is not available but, if requested, information will be given on specific applications.

Pee Wee 3-pin base
(IEC 67-I-19a)


max16.66
12.70
max12.1 1)
2.362
8.74
3.10
1
2
3
6.17
7Z07216

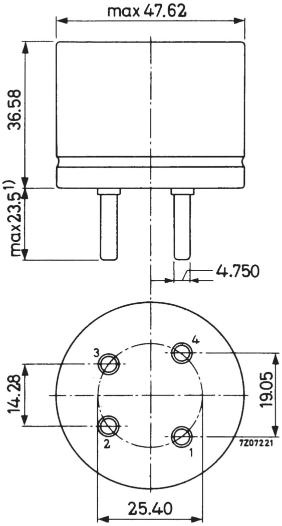
[1]) Including solder

Jumbo 4-pin base
(IEC 67-I-23)


max 47.42
35.43
max9.65 1)
4.750
45°
45°
3
4
2
1
17.45
7Z07222
24.66

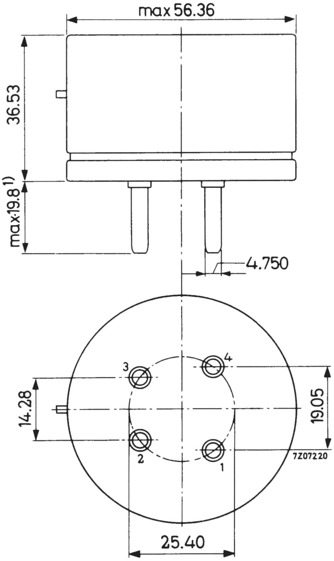
[1]) Including solder

Super Jumbo 4-pin base
(IEC 67-I-28a)


max 47.62
36.58
max23.5 1)
4.750
3
4
2
1
14.28
19.05
7Z07221
25.40

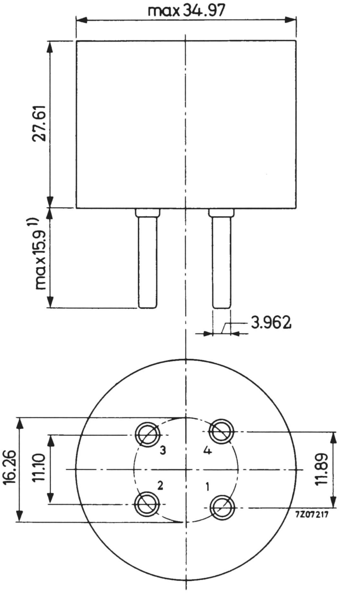
[1]) Including solder

Super Jumbo 4-pin base with bayonet
(IEC 67-I-24)


max 56.36
36.53
max19.8 1)
4.750
3
4
2
1
14.28
19.05
7Z07220
25.40

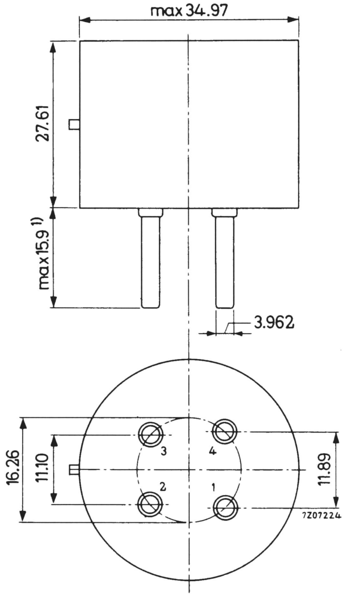
[1]) Including solder

Medium 4-pin base
(IEC 67-I-2)


max 34.97
27.61
max15.9 1)
3.962
16.26
11.10
11.89
3
4
2
1
7Z07217

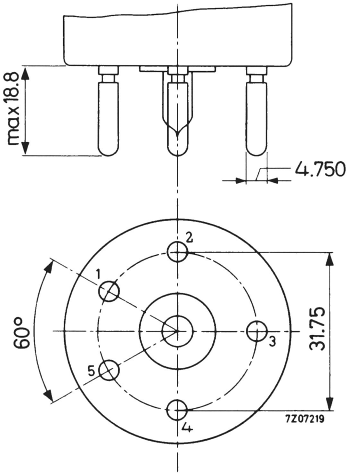
1) Including solder

Medium 4-pin base with bayonet
(IEC 67-I-3)

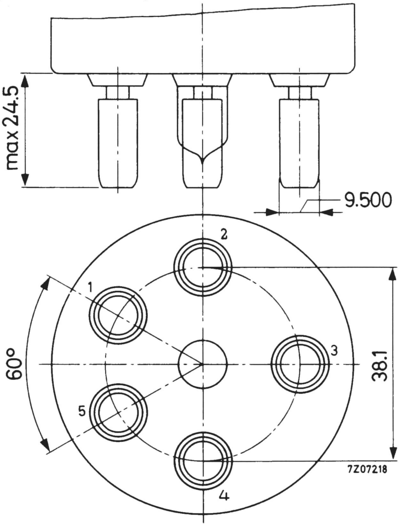

max 34.97
27.61
max15.9 1)
3.962
16.26
11.10
11.89
3
4
2
1
7Z07224

1) Including solder

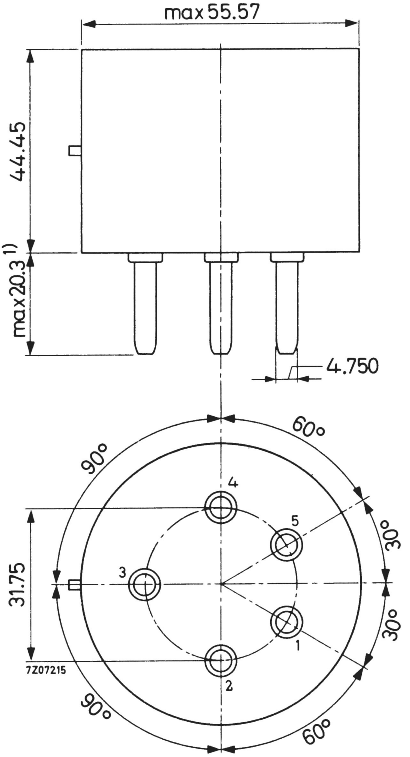
Giant 5-pin base
(IEC 67-I-21c)


max 18.8
4.750
2
1
60°
3
31.75
5
4
7Z07219

Super Giant 5-pin base
(IEC 67-I-22a)

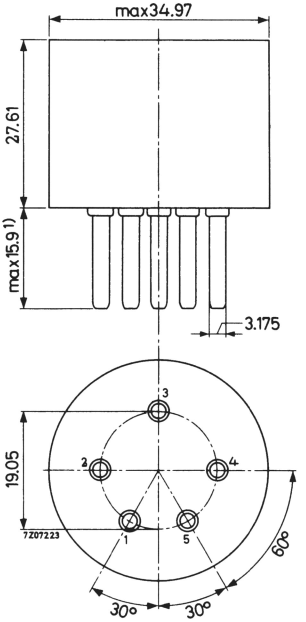

max 24.5
9.500
2
1
60°
3
38.1
5
4
7Z07218

Medium shell Giant 5-pin base
with bayonet
(IEC 67-I-21a)


max 55.57
44.45
max 20.3 1)
4.750
60°
90°
30°
30°
60°
90°
31.75
1
2
3
4
5
7Z07215

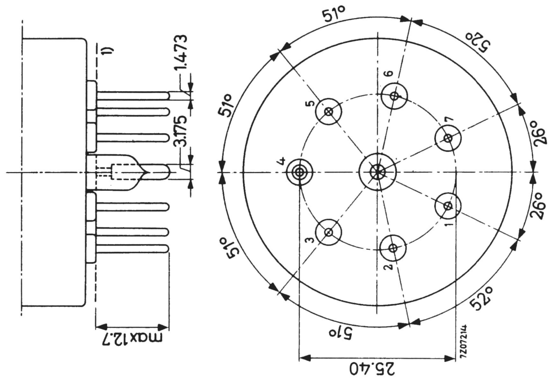
1) Including solder

Medium 5-pin base
(IEC 67-I-4a)


max 34.97
27.61
max 15.9 1)
3.175
19.05
1
2
3
4
5
30°
30°
60°
7Z07223

1) Including solder

Septar 7-pin base
(IEC 67-I-20a)


1)
1.473
3.175
max 12.7
51°
52°
26°
26°
52°
51°
51°
51°
25.40
1
2
3
4
5
6
7
7Z07214

1) The reference line is established by the seating plane of the base and is determined by the three highest bosses.

Triodes

R.F. POWER TRIODES

QUICK REFERENCE DATA

TAL12/10

λ (m)	Freq. (Mc/s)	C telegr.		B teleph.		C_a mod.			B mod. [1]	
		V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)		V_a (kV)	W_o (kW)
>60	< 5	12	10.5			10	7.7		12	17
>15	<20	10	10.5	8	2	8	6		10	16.6
				6	2				8	16.2

TAW12/10

λ (m)	Freq. (Mc/s)	C telegr.		B teleph.		C_a mod.			B mod. [1]	
		V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)		V_a (kV)	W_o (kW)
>60	< 5	12	15	12	3.7	10	7.7		12	30
>15	<20	10	12	10	3.3	8	6		10	25
6	50	6.5	6.5						8	19.5
4	75	4	3.5							

HEATING : direct; filament tungsten, two-phase

Filament voltage, per phase	V_f	=	22	V
Filament current, per phase	I_f	=	38	A

The starting current must never exceed 78 A per phase

Each tube is marked with the value of the filament voltage at which the saturation current has a value of 8 A

CAPACITANCES

Anode to all other elements except grid	C_a	=	4	pF
Grid to all other elements except anode	C_g	=	24.8	pF
Anode to grid	C_{ag}	=	22	pF

COOLING: TAL12/10 forced air cooled TAW12/10 water cooled

---

[1] Two tubes

7Z2 3754

MECHANICAL DATA

TAL12/10

Dimensions in mm

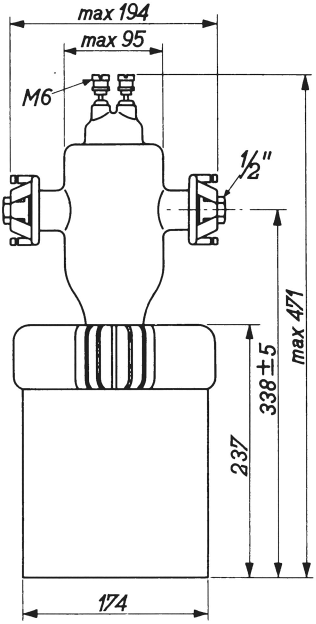
Filament bracket : 40604

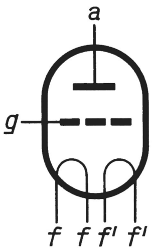
Protective cap for grid seals: 40632

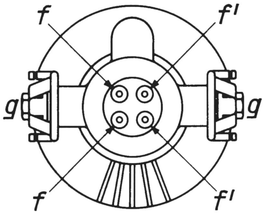
Supporting ring : 40603

Foot : K501

Net weight : 13.5 kg


max 194
max 95
M6
1/2"
max 471
338±5
237
174





Mounting position: exactly vertical with anode down

Pressure loss		p_i =	117	mm H_2O
at	Inlet temperature	t_i =	20	^oC
and	Cooling air flow	q =	5.4	m^3/min

MECHANICAL DATA **TAW12/10**

Dimensions in mm

Filament bracket : 40604

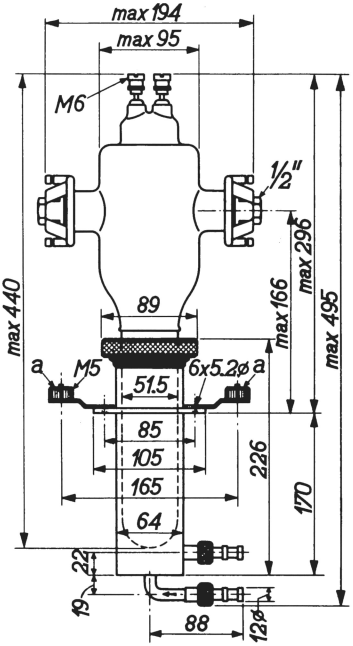
Protective cap for grid seals : 40632

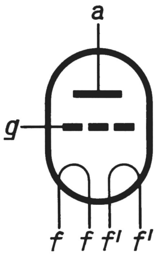
Water-jacket : K700

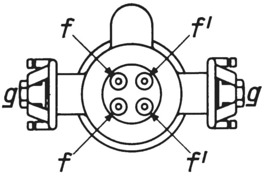
Net weight of the tube : 2 kg

Net weight of the water-jacket: 2.1 kg

O-ring : 3322 026 87801


max 194
max 95
M6
1/2"
max 440
max 296
max 166
max 495
89
a
M5
51.5
6x5.2⌀
a
85
105
165
64
226
170
22
19
88
12⌀





Mounting position: exactly vertical with anode down

Pressure loss p_i = 0.3 atm

with cooling water flow q = 12 l/min

TYPICAL CHARACTERISTICS

Amplification factor	μ	=	22	
Mutual conductance	S (I_a = 0.5 A)	=	7	mA/V
Saturation current	I_{sat}	=	8	A

LIMITING VALUES (Absolute limits)

			TAL12/10	**TAW12/10**	
Anode voltage	V_a	=	max. 12	max. 12	kV
Anode dissipation	W_a	=	max. 4	max. 7.5	kW
Grid dissipation	W_g	=	max. 300	max. 300	W
Grid circuit resistance	R_g	=	max. 10	max. 10	kΩ
Required cooling air flow	$q\left\{\begin{matrix} t_i = 20\ ^{\circ}\mathrm{C} \\ W_a = 4\ \mathrm{kW} \end{matrix}\right\}$	=	min. 5.4	–	m^3/min
Inlet temperature of cooling air	t_i	=	max. 45	–	°C
Anode temperature	t_a	=	max. 150	–	°C
Required cooling water flow	q (W_a = 7.5 kW)	=	–	min. 12	l/min
Outlet temperature of cooling water	t_o	=	–	max. 50	°C
Temperature rise of cooling water	$t_o - t_i$	=	–	max. 11	°C
Temperature of bulb and seals		=	max. 150	max. 150	°C

R.F. POWER TRIODES

QUICK REFERENCE DATA									
λ (m)	Freq. (Mc/s)	C telegr.		B teleph.		C_a mod.		B mod. [1]	
		V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)
>11	<28	12 10	22 18	12	5	10	9.5	12 10	42 16

HEATING: direct; filament tungsten

Filament voltage	V_f	=	21.5	V
Filament current	I_f	=	78	A
Cold filament resistance	R_{fo}	=	0.0224	Ω

The starting current must never exceed 160 A

Each tube is marked with the value of the filament voltage at which the saturation current has a value of 11 A

TYPICAL CHARACTERISTICS

Amplification factor	μ	=	38	
Mutual conductance	S (I_a = 1 A)	=	10	mA/V
Saturation current	I_{sat}	=	11	A

CAPACITANCES			TAL12/20	TAW12/20	
Filament to anode	C_{af}	=	1.9	1.4	pF
Grid to filament	C_{gf}	=	23.5	23.5	pF
Grid to anode	C_{ag}	=	25	25	pF

COOLING: TAL12/20 forced air cooled TAW12/20 water cooled

It is necessary to direct a low-velocity air flow to the grid seals at frequencies higher than 20 Mc/s

---

[1]) Two tubes

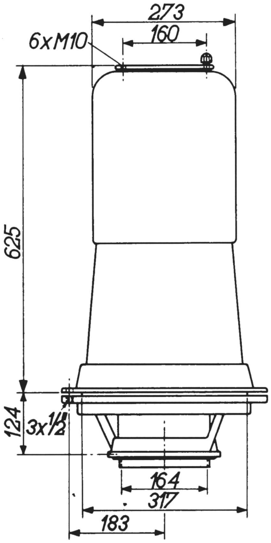
MECHANICAL DATA **TAL12/20** Dimensions in mm

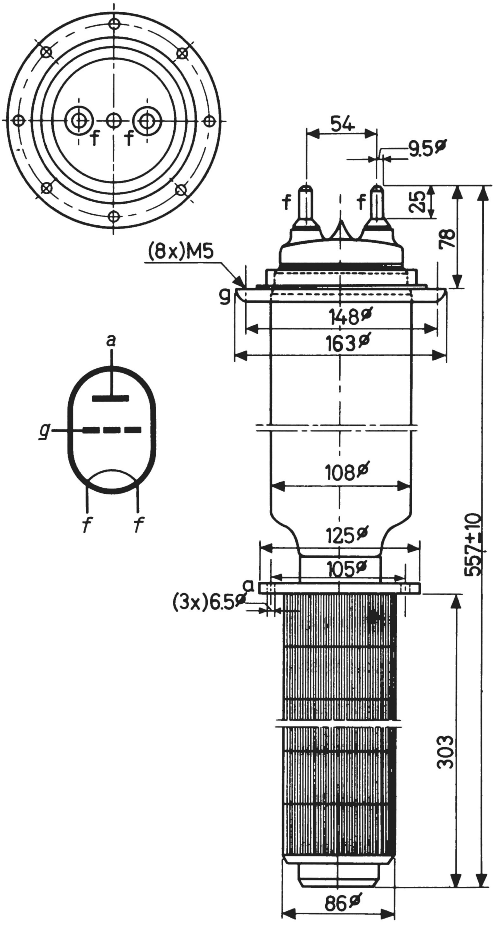
Grid connector : 40664

Filament connector with cable : 40662

Cooling house : K503

Net weight of the tube: 7.5 kg


273
160
6xM10
625
124
3x1/2"
164
317
183


f
f
54
9.5⌀
f
f
25
78
(8x)M5
g
148⌀
163⌀
a
g
f
f
108⌀
125⌀
105⌀
a
(3x)6.5⌀
557±10
303
86⌀

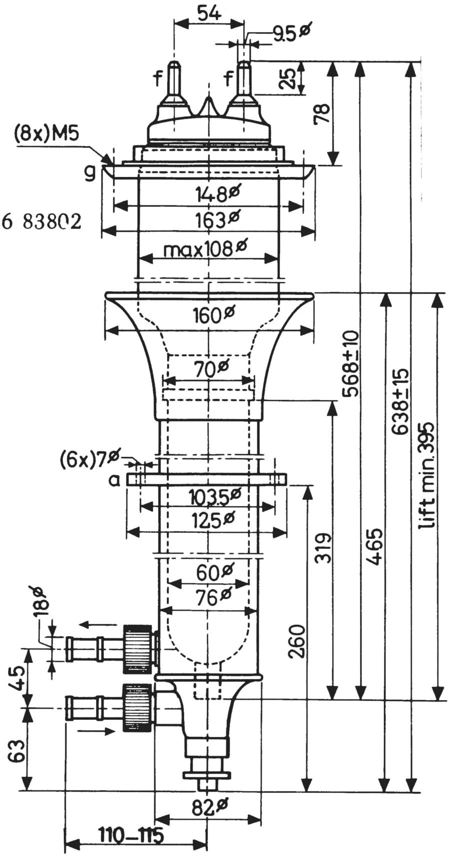
K503/01
Housing with canalized outlet of the air

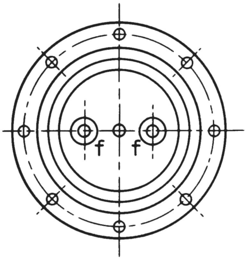
Mounting position:
exactly vertical with anode down

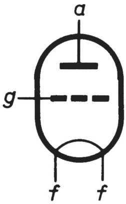
Pressure loss		p_i	=	130	mm H_2O
at	Inlet temperature	t_i	=	20	^oC
and	Cooling air flow	q	=	21.2	m^3/min

MECHANICAL DATA **TAW12/20** Dimensions in mm

Grid connector : 40664
Filament connector with cable : 40662
Water-jacket : K707
Net weight of the tube : 3.6 kg
Net weight of water-jacket : 4.3 kg
O-ring : 3322 026 83802


54
9.5⌀
25
78
f
f
(8x)M5
g
148⌀
163⌀
max108⌀
160⌀
70⌀
568±10
638±15
lift min.395
(6x)7⌀
a
103.5⌀
125⌀
319
465
60⌀
76⌀
18⌀
260
45
63
82⌀
110–115





Mounting position: exactly vertical with anode down

Pressure loss p_i = 0.5 atm

with Cooling water flow q = 20 l/min

LIMITING VALUES (Absolute limits)

			TAL12/20	**TAW12/20**	
Anode voltage	V_a	=	max. 12	max. 12	kV
Anode dissipation	W_a	=	max. 18	max. 18	kW
Grid dissipation	W_g	=	max. 500	max. 500	W
Grid circuit resistance	R_g	=	max. 10	max. 20	kΩ
Required cooling air flow	$q\begin{Bmatrix} t_i = 20\ ^oC \\ W_a = 18\ kW \end{Bmatrix}$	=	min. 21.2	–	m^3/min
Anode temperature	t_a	=	max. 180	–	°C
Required cooling water flow	$q(W_a = 18\ kW)$	=	–	min. 20	l/min
Outlet temperature of cooling water	t_o	=	–	max. 60	°C
Temperature rise of cooling water	$t_o - t_i$	=	–	max. 14	°C
Temperature of bulb and seals		=	max. 150	max. 150	°C

OPERATING CONDITIONS R.F. CLASS C

			Telegraphy		Anode modulation	
Wavelength	λ		>11	>11	>11	m
Anode voltage	V_a	=	12	10	10	kV
Grid voltage	V_g	=	-600	-500	-900	V
Anode current	I_a	=	2.7	2.7	1.4	A
Grid current	I_g	=	0.4	0.42	0.5	A
Peak grid A.C. voltage	V_{gp}	=	1800	1600	2100	V
Grid input power	W_{ig}	=	720	670	1050	W
Anode input power	W_{ia}	=	32.4	27	14	kW
Anode dissipation	W_a	=	10.4	9	4.5	kW
Output power	W_o	=	22	18	9.5	kW
Efficiency	η	=	68	67	68	%
Modulation depth	m	=			100	%
Modulation power	W_{mod}	=			7	kW

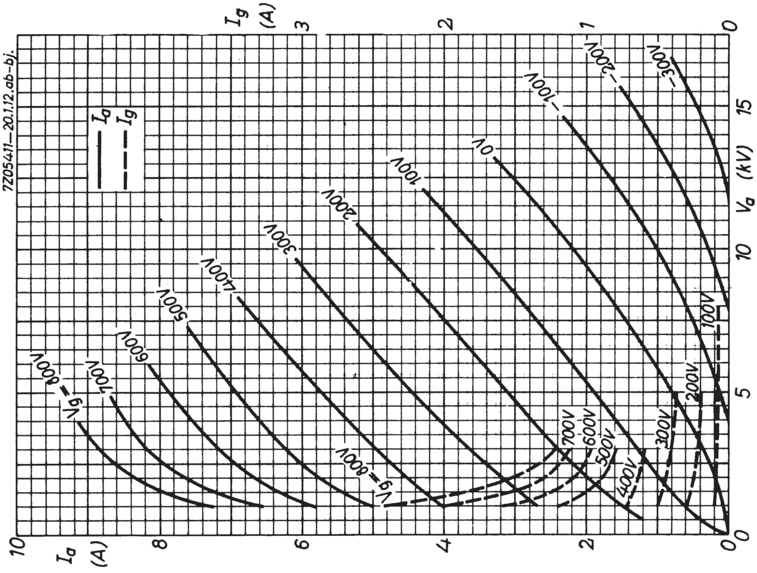
OPERATING CONDITIONS R.F. CLASS B TELEPHONY

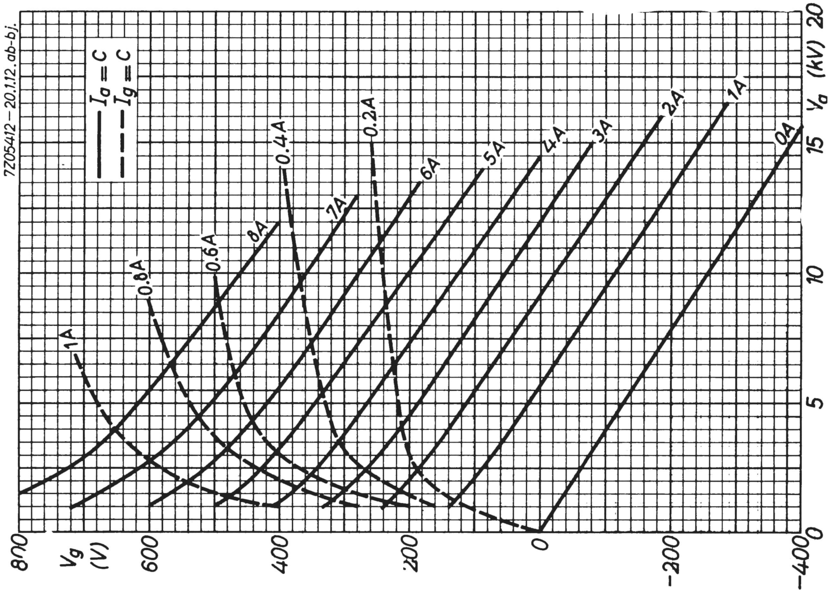
Wavelength	λ	>	11	m
Anode voltage	V_a	=	12	kV
Grid voltage	V_g	=	-200	V
Anode current	I_a	=	1.54	A
Peak grid A.C. voltage	V_{gp}	=	435	V
Anode input power	W_{ia}	=	18.5	kW
Anode dissipation	W_a	=	13.5	kW
Output power	W_o	=	5	kW
Efficiency	η	=	27	%
Modulation depth	m	=	100	%
Grid current	I_g	=	0.24	A
Grid input power	W_{ig}	=	210	W

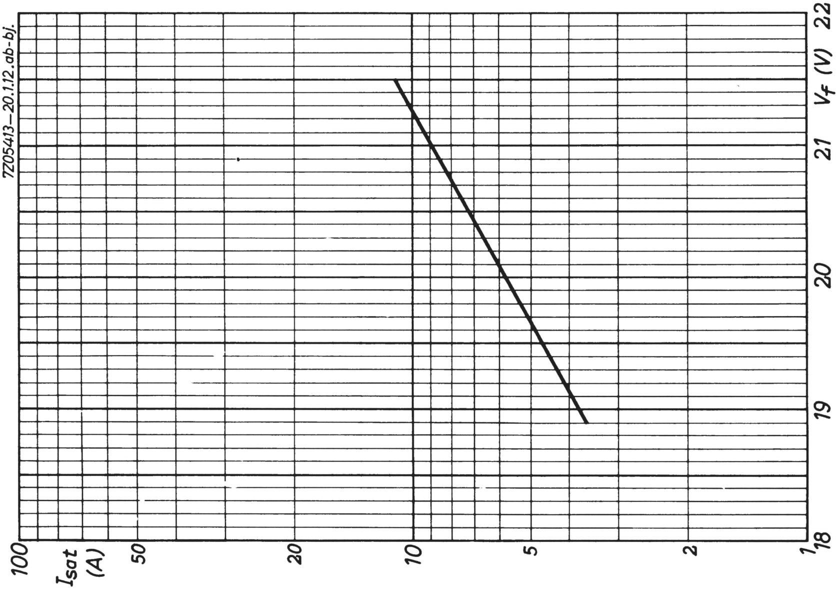
OPERATING CONDITIONS AS A.F. CLASS B AMPLIFIER AND MODULATOR

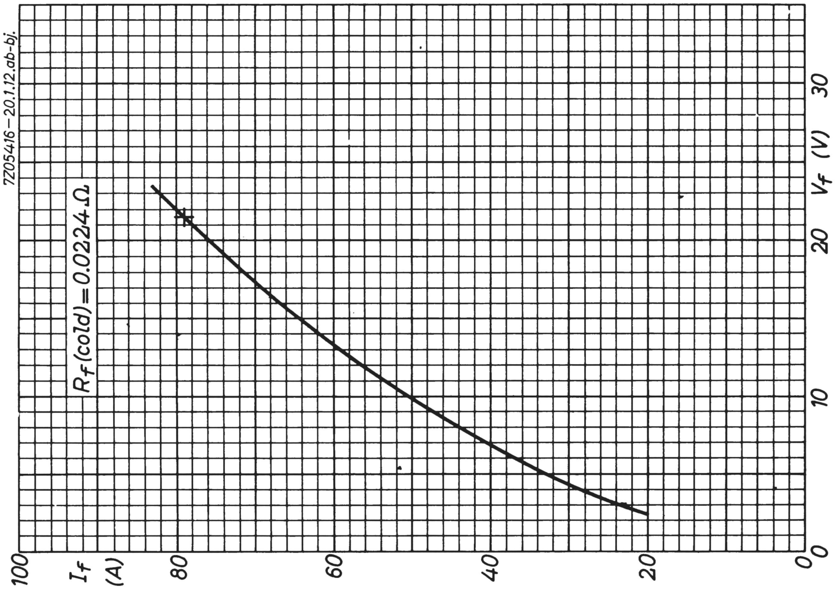
two tubes

Anode voltage	V_a	=	12		10		kV
Grid voltage	V_g	=	-250		-200		V
Load resistance	$R_{aa\sim}$	=	5.6		10.5		kΩ
Peak grid to grid voltage	V_{gg_p}	=	0	1900	0	1100	V
Anode current	I_a	=	2x0.32	2x2.45	2x0.25	2x1.1	A
Grid current	I_g	=	0	2x0.33	0	2x0.17	A
Grid input power	W_{ig}	=	0	2x280	0	2x85	W
Anode input power	W_{ia}	=	2x3.8	2x29	2x2.5	2x11	kW
Anode dissipation	W_a	=	2x3.8	2x8	2x2.5	2x3	kW
Output power	W_o	=	0	42	0	16	kW
Efficiency	η	=	–	72.5	–	73	%
Total harmonic distortion	d_{tot}	=	–	3.1	–	1.7	%


7Z05411–20.1.12.ab-bj.
Ia
Ig
Ia (A)
10
8
6
4
2
0
Ig (A)
3
2
1
0
Va (kV)
0
5
10
15
Vg = 800V
700V
600V
500V
400V
300V
200V
100V
0V
–100V
–200V
–300V
Vg = 800V
700V
600V
500V
400V
300V
200V
100V


7Z05412–20.1.12.ab-bj.
Ia = C
Ig = C
Vg (V)
800
600
400
200
0
–200
–400
Va (kV)
0
5
10
15
20
1A
0.8A
0.6A
0.4A
0.2A
8A
7A
6A
5A
4A
3A
2A
1A
0A


7Z05413–20.1.12.ab-bj.
I_{sat} (A)
100
50
20
10
5
2
1
V_f (V)
18
19
20
21
22


7Z05416–20.1.12.ab-bj.
R_f(cold)=0.0224 Ω
I_f (A)
100
80
60
40
20
0
V_f (V)
0
10
20
30

AIR COOLED R.F. POWER TRIODE

QUICK REFERENCE DATA									
λ (m)	Freq. (MHz)	C telegr.		B teleph.		C_a mod.		B mod. [1]	
		V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)
>15	<20	15	48.5	15	9	12	27	12	80
		12	38	12	8.5			12	38.5
		10	31	10	8	10	21.5	10	77
								10	32
11	27	15	45			12	26		
						10	20.5		
8	37.5	10	26						

HEATING: direct; filament tungsten, three-phase

Filament voltage, per phase	V_f	max.	28.3 V
Filament current, per phase	I_f		48.5 A
Cold filament resistance, per phase	R_{fo}		0.046 Ω

The filament current must never exceed a peak value of 100 A per phase at any time during the initial energizing schedule

Each tube is marked with the value of the filament voltage at which the saturation current has a value of 23 A

CAPACITANCES

Anode to all other elements except grid	C_a	2.6 pF
Grid to all other elements except anode	C_g	72 pF
Anode to grid	C_{ag}	31 pF

COOLING: forced air

---

[1] Two tubes

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	12	kV
Anode current	I_a	=	1.25	A
Amplification factor	μ	=	25	
Mutual conductance	S	=	16.5	mA/V
Saturation current	I_{sat}	=	23	A

TEMPERATURE LIMIT (Absolute limit)

Temperature of seals max. 180 °C

LIMITING VALUES (Absolute limits)

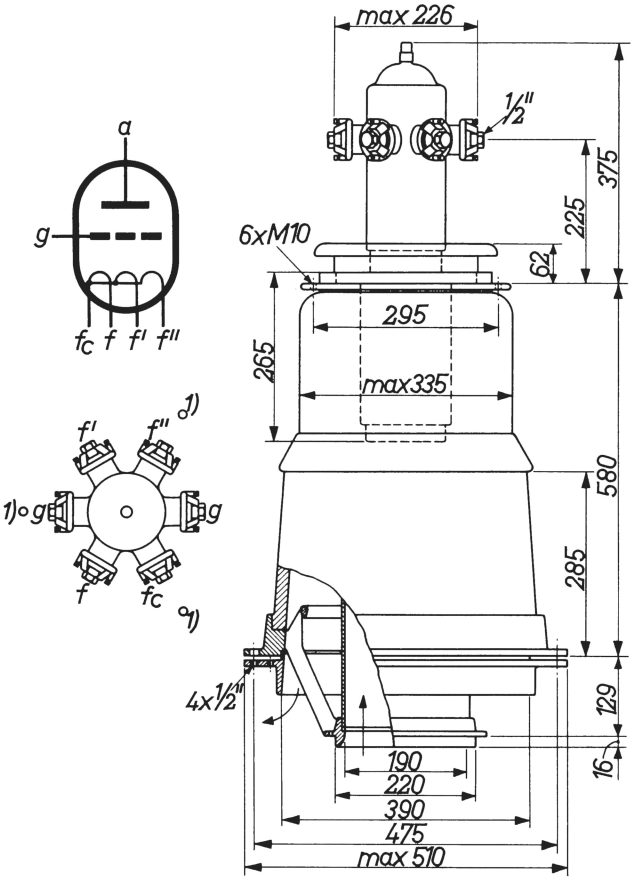
Anode voltage	V_a	max.	15	kV
Negative grid voltage	$-V_g$	max.	1000	V
Anode current	I_a	max.	5	A
Grid current	I_g	max.	0.6	A
Anode input power	W_{ia}	max.	75	kW
Anode dissipation	W_a	max.	18	kW

MECHANICAL DATA Dimensions in mm

Protective caps for grid- and filament seals: 40632

Filament bracket (for D.C. supply) : 40606

Net weight : 20 kg


a
g
fc
f
f'
f''
1)
f'
f''
1)
g
g
f
fc
1)
max 226
1/2"
375
225
6xM10
62
295
265
max335
580
285
129
16
4x1/2"
190
220
390
475
max 510

Tube mounted in cooler housing
type K505

Mounting position: vertical with anode down

---

[1]) Holes for locating pins

WATER COOLED R.F. POWER TRIODE

QUICK REFERENCE DATA

λ (m)	Freq. (Mc/s)	C telegr.		B teleph.		C_a mod.		B mod. [1]	
		V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)
>15	<20	15	48.5	15	9	12	27	12	107
		12	38	12	8.5			12	38.5
		10	31	10	8	10	21.5	10	77
								10	32
11	27	15	45			12	26		
						10	20.5		
8	37.5	10	26						

HEATING: direct; filament tungsten, three-phase

Filament voltage, per phase	V_f	=	max. 28.3	V
Filament current, per phase	I_f	=	48.5	A
Cold filament resistance, per phase	R_{fo}	=	0.046	Ω

The filament current must never exceed a peak value of 100 A per phase at any time during the initial energizing schedule

Each tube is marked with the value of the filament voltage at which the saturation current has a value of 23 A

CAPACITANCES

Anode to all other elements except grid	C_a	=	2.6	pF
Grid to all other elements except anode	C_g	=	72	pF
Anode to grid	C_{ag}	=	31	pF

COOLING: water/air flow to seals

---

[1] Two tubes

7Z2 8624

TYPICAL CHARACTERISTICS

Anode voltage V_a = 12 kV

Anode current I_a = 1.25 A

Amplification factor μ = 25

Mutual conductance S = 16.5 mA/V

Saturation current I_{sat} = 23 A

COOLING CHARACTERISTICS

W_a (kW)	t_i (°C)	q_{min} 1) (l/min)	p_i (atm)
10	20	10	0.03
	50	22	0.15
20	20	18	0.09
	50	40	0.4
30	20	27	0.21
	50	59	1.0

See also the cooling curves

COOLING

It is necessary to direct a low-velocity air flow to the anode and grid seals at frequencies above 10 Mc/s. Cooling of the grid seals can be effected by means of the caps No.40632

TEMPERATURE LIMITS (Absolute limits)

Temperature of seals = max. 180 °C

Inlet temperature of cooling water t_i = max. 50 °C

---

1) At temperatures t_i between 20 and 50 °C the required quantity of water can be found by proportional interpolation

MECHANICAL DATA Dimensions in mm

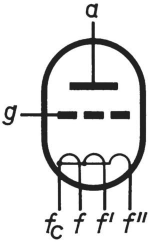
Water-jacket : K715

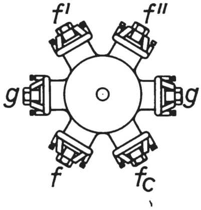
Protective caps for grid and filament seals: 40632

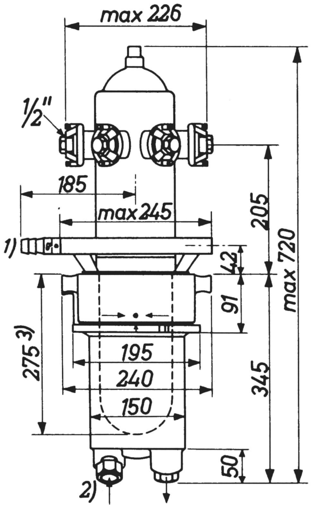
Filament bracket (for D.C. supply) : 40606

Net weight of the tube : 6.8 kg

Net weight of the water-jacket : 16.7 kg






max 226
1/2"
185
max 245
1)
42
205
max 720
91
275 3)
195
240
150
345
50
2)

Tube mounted in water-jacket
type K715

Mounting position: vertical with anode down

---

[1]) Use connecting hose with an inner diameter of 1"

[2]) Coupling for metal tubing with an outer diameter of 28 mm

[3]) For removing the tube from its water-jacket the free height above the tube must be at least 275 mm

7Z2 3774

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	=	max.	15	kV
Negative grid voltage	$-V_g$	=	max.	1000	V
Anode current	I_a	=	max.	5	A
Grid current	I_g	=	max.	0.6	A
Anode input power	W_{ia}	=	max.	75	kW
Anode dissipation	W_a	=	max.	30	kW

OPERATING CONDITIONS

Wavelength	λ	=	>15	>15	>15	11	8	m
Frequency	f	=	<20	<20	<20	27	37.5	Mc/s
Anode voltage	V_a	=	15	12	10	15	10	kV
Grid voltage	V_g	=	-900	-700	-600	-900	-600	V
Anode current	I_a	=	4.2	4.2	4.2	4.2	4.2	A
Grid current	I_g	=	0.42	0.5	0.53	0.42	0.6	A
Peak grid A.C. voltage	V_{gp}	=	1470	1350	1160	1470	1200	V
Grid input power	W_{ig}	=	560	610	560	560	650	W
Anode input power	W_{ia}	=	63	50.4	42	63	42	kW
Anode dissipation	W_a	=	14.5	12.4	11	18	16	kW
Output power	W_o	=	48.5	38	31	45	26	kW
Efficiency	η	=	77	75.5	74	71.5	62	%

R.F. CLASS B TELEPHONY

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	=	max.	15	kV
Anode current	I_a	=	max.	2.5	A
Anode input power	W_{ia}	=	max.	37.5	kW
Anode dissipation	W_a	=	max.	30	kW

OPERATING CONDITIONS

Wavelength	λ		>15	>15	>15	m
Frequency	f		<20	<20	<20	Mc/s
Anode voltage	V_a	=	15	12	10	kV
Grid voltage	V_g	=	−500	−400	−315	V
Anode current	I_a	=	1.8	2.2	2.5	A
Peak grid A.C voltage	V_{g_p}	=	500	470	440	V
Anode input power	W_{ia}	=	27	26.5	25	kW
Anode dissipation	W_a	=	18	18	17	kW
Output power	W_o	=	9	8.5	8	kW
Efficiency	η	=	33	32	32	%
Modulation depth	m	=	100	100	100	%
Grid current	I_g	=	0.3	0.36	0.4	A
Grid input power	W_{ig}	=	270	305	317	W

7Z2 3776

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	=	max.	12	kV
Negative grid voltage	$-V_g$	=	max.	1000	V
Anode current	I_a	=	max.	2.9	A
Grid current	I_g	=	max.	0.6	A
Anode input power	W_{ia}	=	max.	35	kW
Anode dissipation	W_a	=	max.	20	kW

OPERATING CONDITIONS

Wavelength	λ	=	>15	>15	11	11	m
Frequency	f	=	<20	<20	27	27	Mc/s
Anode voltage	V_a	=	12	10	12	10	kV
Grid voltage	V_g	=	-1000	-900	-1000	-900	V 1)
Anode current	I_a	=	2.9	2.9	2.9	2.9	A
Grid current	I_g	=	0.4	0.45	0.45	0.5	A
Peak grid A.C. voltage	V_{gp}	=	1600	1550	1650	1600	V
Grid input power	W_{ig}	=	580	630	670	700	W
Anode input power	W_{ia}	=	35	29	35	29	kW
Anode dissipation	W_a	=	8	7.5	9	8.5	kW
Output power	W_o	=	27	21.5	26	20.5	kW
Efficiency	η	=	77	74	74	70.5	%
Modulation depth	m	=	100	100	100	100	%
Modulation power	W_{mod}	=	17.5	14.5	17.5	14.5	kW

---

1) Grid bias partially obtained by the grid resistor

A.F. CLASS B AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute limits)

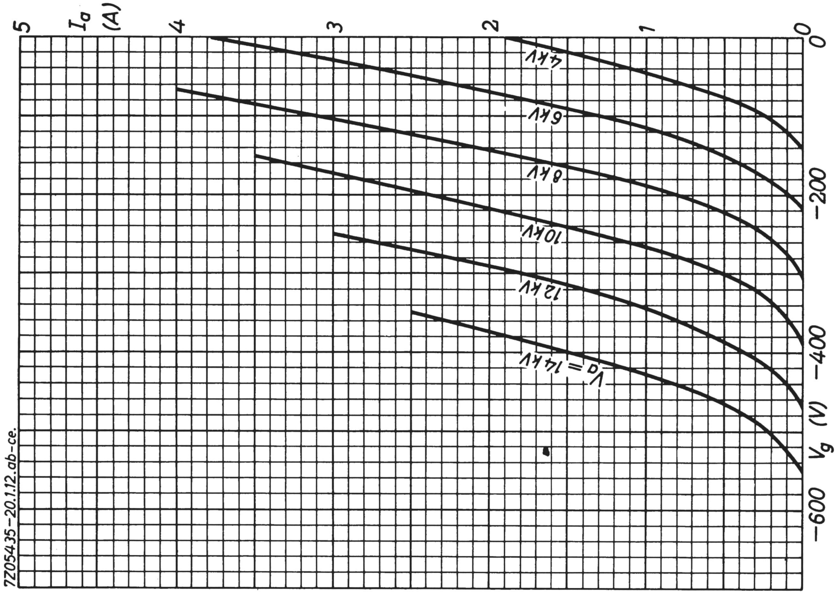
Anode voltage	V_a	=	max.	15	kV
Anode current	I_a	=	max.	6	A
Anode input power	W_{ia}	=	max.	90	kW
Anode dissipation	W_a	=	max.	30	kW

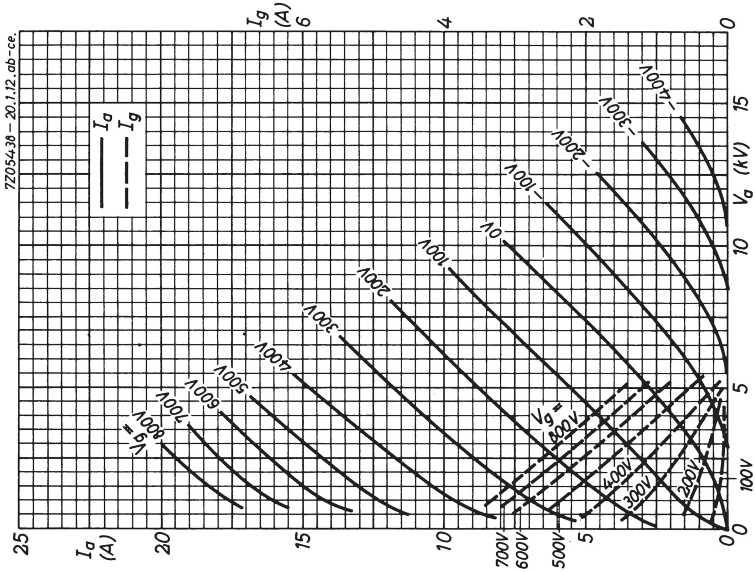
OPERATING CONDITIONS, two tubes in push-pull

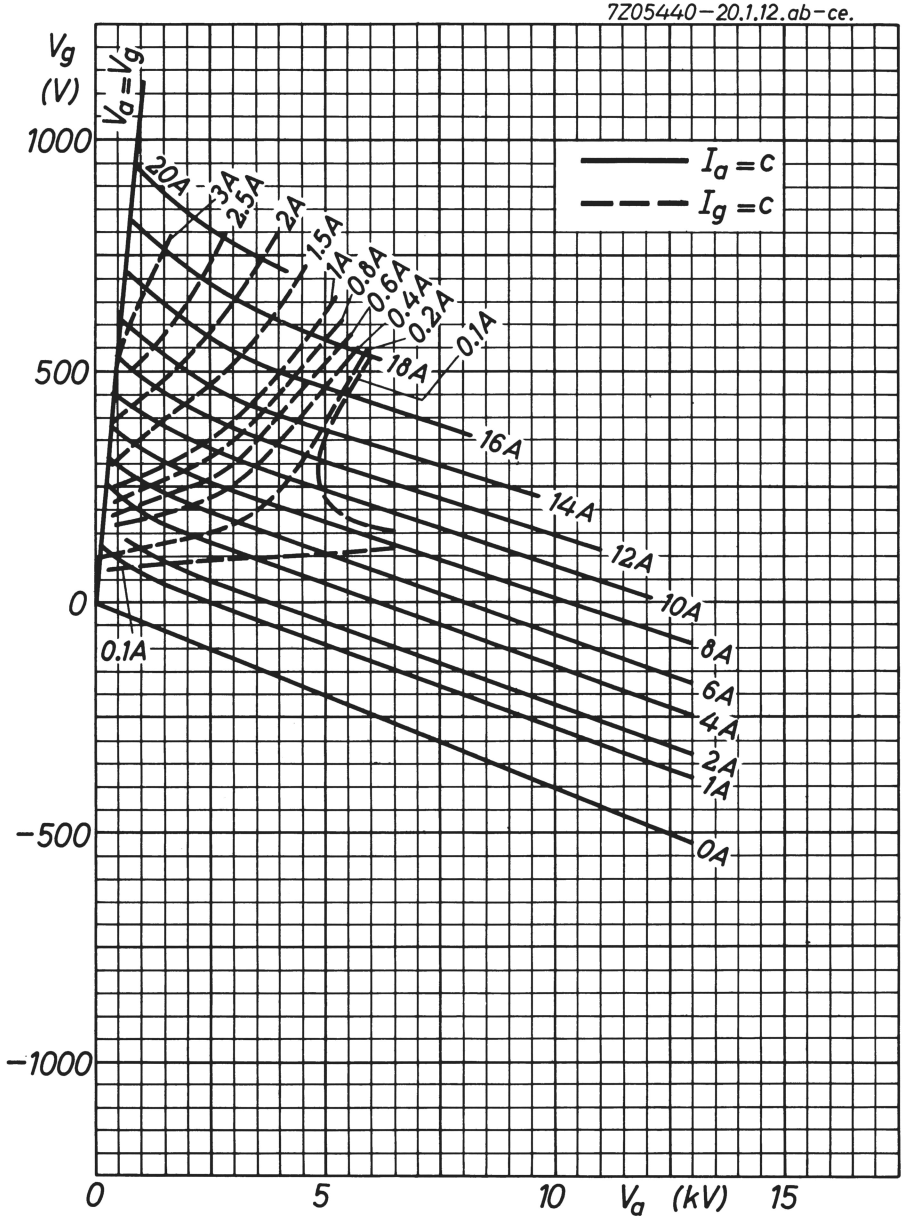
Anode voltage	V_a	=	12		12		kV
Grid voltage	V_g	=	−400		−425		V
Load resistance	$R_{aa\sim}$	=	2.4		5.8		kΩ
Peak grid to grid voltage	V_{ggp}	=	0	2400	0	1480	V
Anode current	I_a	=	2x0.35	2x6	2x0.15	2x2.25	A
Grid current	I_g	=	0	2x0.6	0	2x0.19	A
Peak grid current	I_{gp}	=	0	2x3.3	0	2x1.25	A
Grid input power	W_{ig}	=	0	2x650	0	2x127	W
Anode input power	W_{ia}	=	2x4.2	2x72	2x1.8	2x27	kW
Anode dissipation	W_a	=	2x4.2	2x18.5	2x1.8	2x7.7	kW
Output power	W_o	=	0	107	0	38.5	kW
Total distortion	d_{tot}	=	–	4	–	3.7	%
Efficiency	η	=	–	74.5	–	71.5	%

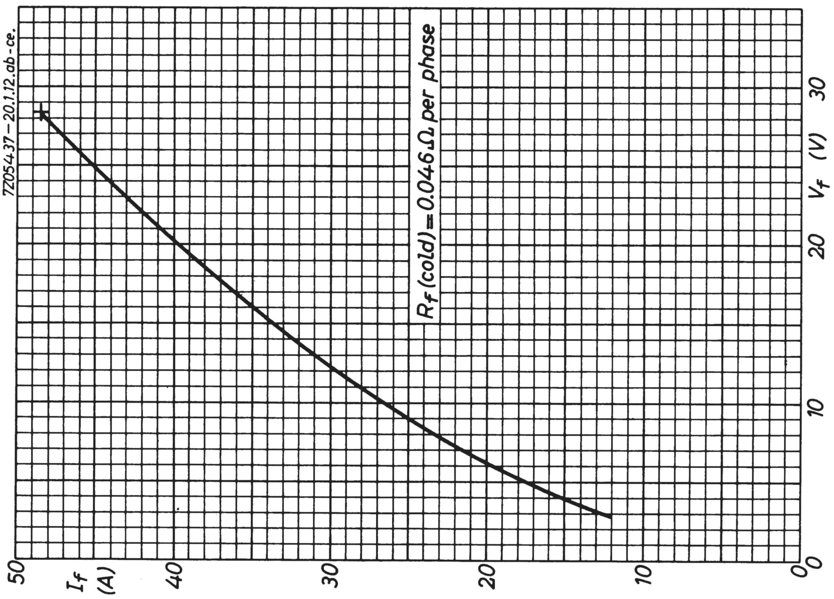
Anode voltage	V_a	=	10		10		kV
Grid voltage	V_g	=	−325		−345		V
Load resistance	$R_{aa\sim}$	=	2.1		5		kΩ
Peak grid to grid voltage	V_{ggp}	=	0	2050	0	1330	V
Anode current	I_a	=	2x0.3	2x5.4	2x0.14	2x2.25	A
Grid current	I_g	=	0	2x0.6	0	2x0.2	A
Peak grid current	I_{gp}	=	0	2x3	0	2x1.35	A
Grid input power	W_{ig}	=	0	2x555	0	2x120	W
Anode input power	W_{ia}	=	2x3	2x54	2x1.4	2x22.5	kW
Anode dissipation	W_a	=	2x3	2x15.5	2x1.4	2x6.5	kW
Output power	W_o	=	0	77	0	32	kW
Total distortion	d_{tot}	=	–	3.5	–	4	%
Efficiency	η	=	–	71.5	–	71	%

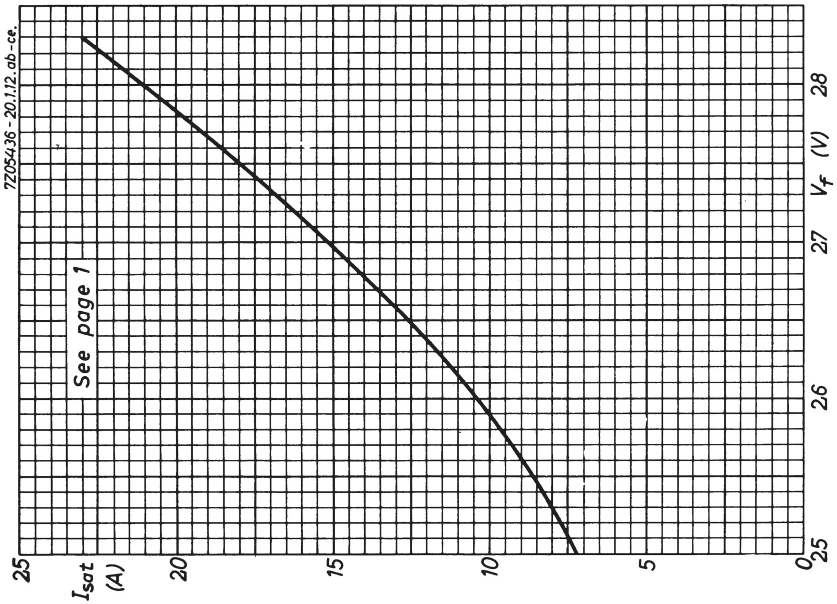
7Z2 3778


Ia (A)
5
4
3
2
1
0
Vg (V)
0
−200
−400
−600
4kV
6kV
8kV
10kV
12kV
Va = 14kV
7Z05435−20.1.12.ab-ce.


Ig (A)
6
4
2
0
Va (kV)
0
5
10
15
Ia (A)
25
20
15
10
5
0
Ia
Ig
Vg = 800V
700V
600V
500V
400V
300V
200V
100V
0V
−100V
−200V
−300V
−400V
Vg = 800V
700V
600V
500V
400V
300V
200V
100V
7Z05438 − 20.1.12.ab-ce.


7Z05440−20.1.12.ab−ce.
V_g (V)
1000
500
0
−500
−1000
0
5
10
V_a (kV)
15
$V_a = V_g$
$I_a = c$
$I_g = c$
20A
18A
16A
14A
12A
10A
8A
6A
4A
2A
1A
0A
3A
2.5A
2A
1.5A
1A
0.8A
0.6A
0.4A
0.2A
0.1A
0.1A


7Z05437-20.1.12.ab-ce.
R_f (cold) = 0.046 Ω per phase
I_f (A)
50
40
30
20
10
0
V_f (V)
0
10
20
30


7Z05436-20.1.12.ab-ce.
See page 1
I_{sat} (A)
25
20
15
10
5
0
V_f (V)
25
26
27
28

R.F. POWER TRIODE

QUICK REFERENCE DATA									
λ (m)	Freq. (Mc/s)	C telegr.		C osc.		B teleph.		C_a mod.	
		V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)
4	75	2500	390			2500	65	2000	204
		2000	295			2000	64	1500	153
		1500	210			1500	59	1000	95
		1000	126						
2	150			2500	376				
				2000	282				
1.5	200			2000	198				

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	6.3	V
Filament current	I_f	=	5.4	A

CAPACITANCES

Anode to all other elements except grid	C_a	=	0.1	pF
Grid to all other elements except anode	C_g	=	4.3	pF
Anode to grid	C_{ag}	=	5.2	pF

TYPICAL CHARACTERISTICS

Amplification factor	μ	=	25	
Mutual conductance	S (I_a = 44 mA)	=	2.8	mA/V

COOLING: radiation/low-velocity air flow

It is necessary to direct a low-velocity air flow to the bottom and the top seal if the tube is used at or near the limiting values at frequencies above 50 Mc/s.

7Z2 3779

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	=	max. 2500	V
Anode dissipation	W_a	=	max. 135	W [1])
Grid dissipation	W_g	=	max. 16	W
Grid circuit resistance with fixed grid bias	R_g	=	max. 0.1	MΩ
Grid circuit resistance with automatic grid bias	R_g	=	max. 0.2	MΩ
Cathode current	I_k	=	max. 250	mA
Peak cathode current	I_{kp}	=	max. 1.6	A
Temperature of anode seal		=	max. 220	°C
Bottom temperature		=	max. 180	°C

MECHANICAL DATA

Dimensions in mm

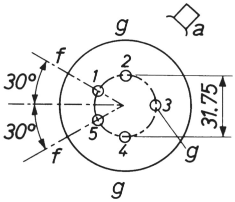
Base : giant 5p

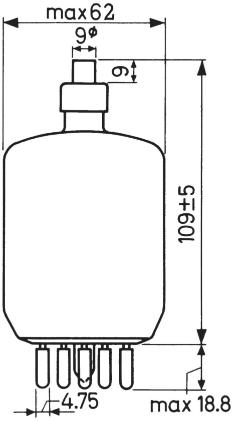
Anode connector : 40624

Socket : 2422 512 01001

Socket with grounded grid connections: 40215/01

Net weight : 110 g





Mounting position: vertical with base up or down

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1) Anode red hot, temperature = 850 °C

7Z2 8626

OPERATING CONDITIONS R.F. CLASS C TELEGRAPHY

Wavelength	λ	=	4	4	4	4	m
Anode voltage	V_a	=	2500	2000	1500	1000	V
Grid voltage	V_g	=	-200	-150	-110	-80	V
Anode current	I_a	=	205	205	205	205	mA
Grid current	I_g	=	40	40	40	40	mA
Peak grid A.C. voltage	V_{gp}	=	390	340	300	260	V
Grid input power	W_{ig}	=	14	13	11	10	W
Anode input power	W_{ia}	=	512	410	308	205	W
Anode dissipation	W_a	=	122	115	98	79	W
Output power	W_o	=	390	295	210	126	W
Efficiency	η	=	76	72	68	61.5	%

OPERATING CONDITIONS R.F. CLASS B TELEPHONY

Wavelength	λ	=	4	4	4	m
Anode voltage	V_a	=	2500	2000	1500	V
Grid voltage	V_g	=	-87	-67	-45	V
Anode current	I_a	=	77	97	120	mA
Peak grid A.C. voltage	V_{gp}	=	100	100	100	V
Anode input power	W_{ia}	=	193	194	180	W
Anode dissipation	W_a	=	128	130	121	W
Output power	W_o	=	65	64	59	W
Efficiency	η	=	34	33	33	%
Modulation depth	m	=	100	100	100	%
Grid current	I_g	=	20	28	52	mA
Grid input power	W_{ig}	=	3.6	5.1	9.4	W

7Z2 3781

OPERATING CONDITIONS R.F. CLASS C ANODE MODULATION; two tubes

Wavelength	λ	=	4	4	4	m
Anode voltage	V_a	=	2000	1500	1000	V
Grid voltage	V_g	=	−225	−180	−130	V
Anode current	I_a	=	255	255	255	mA
Grid current	I_g	=	80	80	80	mA
Peak grid A.C. voltage	V_{gp}	=	415	370	320	V
Grid input power	W_{ig}	=	30	27	23	W
Anode input power	W_{ia}	=	510	382	255	W
Anode dissipation	W_a	=	102	76	65	W
Output power	W_o	=	408	306	190	W
Efficiency	η	=	80	80	74.5	%
Modulation depth	m	=	100	100	100	%
Modulation power	W_{mod}	=	255	191	126	W

OPERATING CONDITIONS AS R.F. CLASS C OSCILLATOR; two tubes

Wavelength	λ	=	2	2	1.5	m
Anode voltage	V_a	=	2500	2000	2000	V
Anode current	I_a	=	410	410	346	mA
Grid current	I_g	=	80	80	80	mA
Grid resistor	R_g	=	2500	1875	1875	Ω
Anode input power	W_{ia}	=	1025	820	692	W
Anode dissipation	W_a	=	245	230	270	W
Grid input power	W_{ig}	=	28	26	26	W
Output power	W_o	=	752	564	396	W
Efficiency	η	=	73	69	57	%

7Z2 3782

OPERATING CONDITIONS AS R.F. CLASS C OSCILLATOR for high frequency heating and diathermy generators

A. With anode voltage from single-phase full-wave rectifier without filter

Wavelength	λ	=	7.3	m
Anode voltage	V_a	=	2000	V [1]
Anode current	I_a	=	170	mA
Grid current	I_g	=	34	mA
Grid resistor	R_g	=	3750	Ω
Anode input power	W_{ia}	=	420	W
Anode dissipation	W_a	=	120	W
Grid input power	W_{ig}	=	10	W
Output power	W_o	=	290	W
Efficiency	η	=	69	%

B. With anode and grid alternating voltage. Phase-shift of 180° between V_a and V_g

Wavelength	λ	=	7.3	m
Anode voltage	V_a	=	2500	V_{RMS}
Anode current	I_a	=	90	mA
Grid current	I_g	=	20	mA
Grid resistor	R_g	=	1700	Ω
Grid voltage	V_g	=	85	V_{RMS}
Anode input power	W_{ia}	=	255	W
Anode dissipation	W_a	=	85	W
Output power	W_o	=	170	W
Efficiency	η	=	67	%

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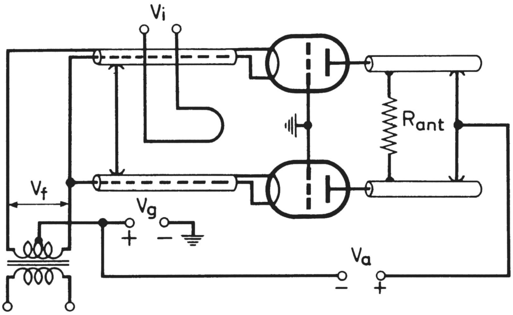
[1] Mean value

7Z2 3783

OPERATING CONDITIONS R.F. CLASS C TELEGRAPHY

grounded grid, two tubes



Wavelength	λ	=	3	3	3	3	m
Anode voltage	V_a	=	2500	2000	1500	1000	V
Grid voltage	V_g	=	−200	−150	−110	−80	V
Anode current	I_a	=	410	410	410	410	mA
Grid current	I_g	=	80	80	80	80	mA
Peak grid A.C. voltage	V_{gp}	=	390	340	300	260	V
Grid input power	W_{ig}	=	158	136	118	100	W
Anode input power	W_{ia}	=	1025	820	615	410	W
Anode dissipation	W_a	=	245	230	195	158	W
Output power	W_o	=	780+130	590+110	420+96	252+80	W¹)
Efficiency	η	=	76	72	68	61.5	%²)

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1) Power transferred from driving stage included

2) Pure tube efficiency

7Z2 3784

A.F. CLASS B AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute limits)

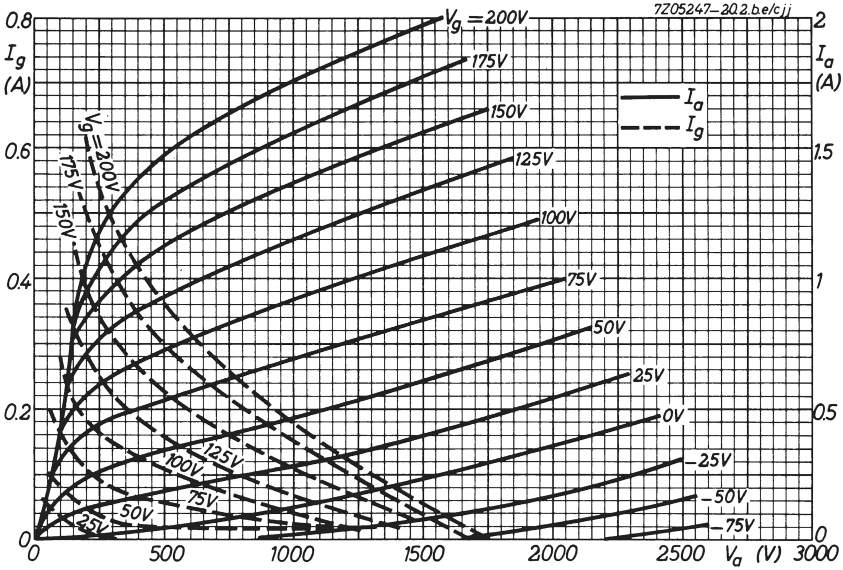
Anode voltage	V_a	=	max.	2500	V
Anode dissipation	W_a	=	max.	135	W
Grid dissipation	W_g	=	max.	16	W
Cathode current	I_k	=	max.	250	mA
Peak cathode current	I_{kp}	=	max.	1.6	A

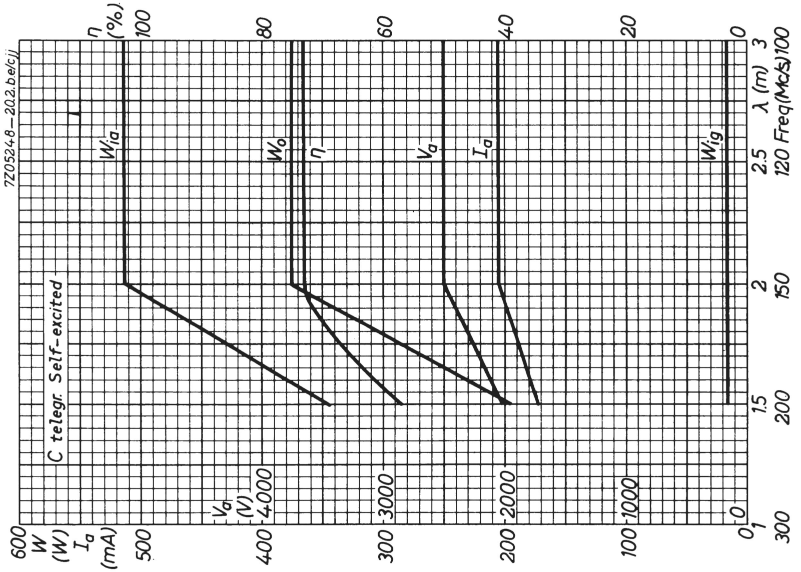
OPERATING CONDITIONS, two tubes

Anode voltage	V_a	=	2500		2000		V
Grid voltage	V_g	=	-86		-65		V
Load resistance	$R_{aa\sim}$	=	18.2		12.0		kΩ
Peak grid to grid voltage	V_{ggp}	=	0	412	0	394	V
Anode current	I_a	=	2x30	2x178	2x30	2x208	mA
Grid current	I_g	=	0	2x42	0	2x42	mA
Grid input power	W_{ig}	=	0	2x7.8	0	2x7.3	W
Anode input power	W_{ia}	=	2x75	2x445	2x60	2x416	W
Anode dissipation	W_a	=	2x75	2x95	2x60	2x101	W
Output power	W_o	=	0	700	0	630	W
Total harmonic distortion	d_{tot}	=	-	5.0	-	3.7	%
Efficiency	η	=	-	78.5	-	76	%

Anode voltage	V_a	=	1500		1000		V
Grid voltage	V_g	=	-46		-23		V
Load resistance	$R_{aa\sim}$	=	8.5		5.0		kΩ
Peak grid to grid voltage	V_{ggp}	=	0	340	0	295	V
Anode current	I_a	=	2x30	2x210	2x30	2x210	mA
Grid current	I_g	=	0	2x40	0	2x40	mA
Grid input power	W_{ig}	=	0	2x6.1	0	2x5.4	W
Anode input power	W_{ia}	=	2x45	2x315	2x30	2x210	W
Anode dissipation	W_a	=	2x45	2x90	2x30	2x73	W
Output power	W_o	=	0	450	0	274	W
Total harmonic distortion	d_{tot}	=	-	2.9	-	2.2	%
Efficiency	η	=	-	71.5	-	65	%

7Z2 3785


7Z05247–20.2.b.e/cjj
0.8
0.6
0.4
0.2
0
I_g (A)
2
1.5
1
0.5
0
I_a (A)
0
500
1000
1500
2000
2500
3000
V_a (V)
V_g = 200V
175V
150V
125V
100V
75V
50V
25V
0V
−25V
−50V
−75V
V_g = 200V
175V
150V
125V
100V
75V
50V
25V
I_a
I_g


7Z05248–20.2.b.e/cjj
C telegr. Self-excited
η (%)
100
80
60
40
20
0
W_{ia}
W_o
η
V_a
I_a
W_{ig}
λ (m)
3
2.5
2
1.5
1
Freq (Mc/s)
100
120
150
200
300
V_a (V)
4000
3000
2000
1000
0
W (W)
I_a (mA)
600
500
400
300
200
100
0

R.F. POWER TRIODE

QUICK REFERENCE DATA

λ (m)	Freq. (Mc/s)	C telegr.		C grounded grid		B teleph.		C_a mod.	
		V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)
2	150	2500	390			2500	65		
		2000	295			2000	64	2000	205
		1500	210			1500	59	1500	154
		1000	126					1000	96
3	100			2500	910				
				2000	700				
				1500	516				
				1000	332				

λ (m)	Freq. (Mc/s)	C osc. industrial				B mod. two tubes	
		V_a ∩∩ (V)	W_o (W)	V_a ∿ (V)	W_o (W)	V_a (V)	W_o (W)
6	50	2000	290	2500	170	2500	700
						1000	274

HEATING: direct; filament thoriated tungsten

Filament voltage V_f = 6.3 V

Filament current I_f = 5.8 A

CAPACITANCES

Anode to all other elements except grid C_a = 0.1 pF

Grid to all other elements except anode C_g = 4.9 pF

Anode to grid C_{ag} = 5.0 pF

TYPICAL CHARACTERISTICS

Anode voltage V_a = 2500 V

Anode current I_a = 60 mA

Amplification factor μ = 25

Mutual conductance S = 2.8 mA/V

7Z2 3440

TEMPERATURE LIMITS (Absolute limits)

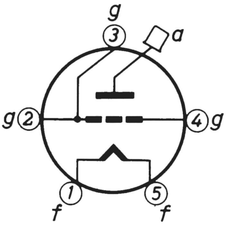
Temperature of anode seal	=	max. 220 °C
Bottom temperature	=	max. 180 °C

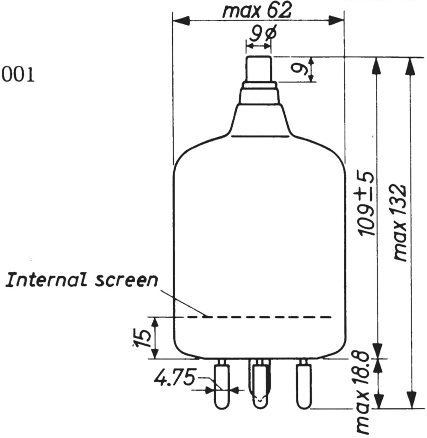
It is recommended to direct a low-velocity air flow on bottom and top seal if the tube is used at or near the limiting values at frequencies above 50 Mc/s

MECHANICAL DATA

Dimensions in mm

Base	:	giant 5p
Socket	:	2422 512 01001
Anode connector	:	40624
Net weight	:	125 g


g
3
a
g
2
4
g
1
5
f
f


max 62
9ø
9
109±5
max 132
Internal screen
15
4.75
max 18.8

Mounting position: vertical with base up or down

COOLING: radiation/low-velocity air flow

7Z2 8627

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

Frequency	f		up to	150	Mc/s
Anode voltage	V_a	=	max.	3000	V
Anode current	I_a	=	max.	255	mA
Anode dissipation	W_a	=	max.	150	W
Anode input power	W_{ia}	=	max.	512	W
Negative grid voltage	$-V_g$	=	max.	300	V
Grid current	I_g	=	max.	45	mA
Grid circuit resistance with fixed grid bias	R_g	=	max.	0.1	MΩ
Grid circuit resistance with automatic grid bias	R_g	=	max.	0.2	MΩ

OPERATING CONDITIONS

Frequency	f	=	150	150	150	150	Mc/s
Anode voltage	V_a	=	2500	2000	1500	1000	V
Grid voltage	V_g	=	-200	-150	-110	-80	V
Anode current	I_a	=	205	205	205	205	mA
Grid current	I_g	=	40	40	40	40	mA
Peak grid A.C. voltage	V_{gp}	=	390	340	300	260	V
Grid input power	W_{ig}	=	14	13	11	10	W
Anode input power	W_{ia}	=	512	410	308	205	W
Anode dissipation	W_a	=	122	115	98	79	W
Output power	W_o	=	390	295	210	126	W
Efficiency	η	=	76	72	68	61.5	%

7Z2 3442

R.F. CLASS B TELEPHONY

LIMITING VALUES (Absolute limits)

Frequency	f		up to	150	Mc/s
Anode voltage	V_a	=	max.	3000	V
Anode current	I_a	=	max.	170	mA
Anode dissipation	W_a	=	max.	150	W
Anode input power	W_{ia}	=	max.	200	W
Grid current	I_g	=	max.	55	mA
Grid circuit resistance with fixed grid bias	R_g	=	max.	0.1	MΩ
Grid circuit resistance with automatic grid bias	R_g	=	max.	0.2	MΩ

OPERATING CONDITIONS

Frequency	f	=	150	150	150	Mc/s
Anode voltage	V_a	=	2500	2000	1500	V
Grid voltage	V_g	=	-87	-67	-45	V
Anode current	I_a	=	77	97	120	mA
Peak grid A.C. voltage	V_{gp}	=	100	100	100	V
Anode input power	W_{ia}	=	193	194	180	W
Anode dissipation	W_a	=	128	130	121	W
Output power	W_o	=	65	64	59	W
Efficiency	η	=	34	33	33	%
Modulation factor	m	=	100	100	100	%
Grid current	I_g	=	20	28	52	mA
Grid input power	W_{ig}	=	3.6	5.1	9.4	W

7Z2 3443

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

Frequency	f		up to	150	Mc/s
Anode voltage	V_a	=	max.	2400	V
Anode current	I_a	=	max.	170	mA
Anode dissipation	W_a	=	max.	100	W
Anode input power	W_{ia}	=	max.	340	W
Negative grid voltage	$-V_g$	=	max.	300	V
Grid current	I_g	=	max.	45	mA
Grid circuit resistance with fixed grid bias	R_g	=	max.	0.1	MΩ
Grid circuit resistance with automatic grid bias	R_g	=	max.	0.2	MΩ

OPERATING CONDITIONS

Frequency	f	=	150	150	150	Mc/s
Anode voltage	V_a	=	2000	1500	1000	V
Grid voltage	V_g	=	−225	−180	−130	V
Anode current	I_a	=	128	128	128	mA
Grid current	I_g	=	40	40	40	mA
Peak grid A.C. voltage	V_{gp}	=	415	370	320	V
Grid input power	W_{ig}	=	15	14	12	W
Anode input power	W_{ia}	=	256	192	128	W
Anode dissipation	W_a	=	51	38	32	W
Output power	W_o	=	205	154	96	W
Efficiency	η	=	80	80	75	%
Modulation factor	m	=	100	100	100	%
Modulation power	W_{mod}	=	128	96	64	W

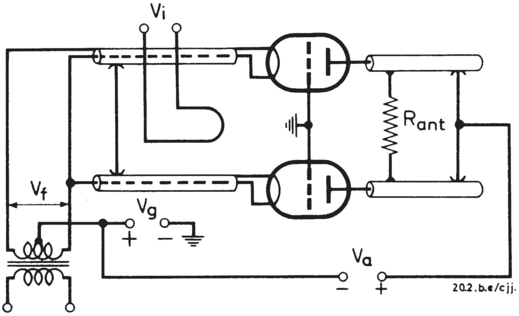
7Z2 3444

R.F. CLASS C TELEGRAPHY, grounded grid

LIMITING VALUES (Absolute limits)

Frequency	f		up to	150	Mc/s
Anode voltage	V_a	=	max.	3000	V
Anode current	I_a	=	max.	205	mA
Anode dissipation	W_a	=	max.	150	W
Anode input power	W_{ia}	=	max.	512	W
Negative grid voltage	$-V_g$	=	max.	300	V
Grid current	I_g	=	max.	45	mA
Grid circuit resistance with fixed grid bias	R_g	=	max.	0.1	MΩ
Grid circuit resistance with automatic grid bias	R_g	=	max.	0.2	MΩ

OPERATING CONDITIONS, two tubes



Frequency	f	=	100	100	100	100	Mc/s	
Anode voltage	V_a	=	2500	2000	1500	1000	V	
Grid voltage	V_g	=	−200	−150	−110	−80	V	
Anode current	I_a	=	410	410	410	410	mA	
Grid current	I_g	=	80	80	80	80	mA	
Peak grid A.C. voltage	V_{gp}	=	390	340	300	260	V	
Grid input power	W_{ig}	=	158	136	118	100	W	
Anode input power	W_{ia}	=	1025	820	615	410	W	
Anode dissipation	W_a	=	245	230	195	158	W	
Output power	W_o	=	780+130	590+110	420+96	252+80	W	1)
Efficiency	η	=	76	72	68	61.5	%	2)

---

1) Power transferred from driving stage included

2) Pure tube efficiency

7Z2 3445

R.F. CLASS C OSCILLATOR for high-frequency heating and diathermy generators, with anode voltage from single-phase full-wave rectifier without filter

LIMITING VALUES (Absolute limits)

Frequency	f		up to	150	Mc/s
Anode voltage	V_a	=	max.	2700	V [1]
Anode current	I_a	=	max.	180	mA
Anode dissipation	W_a	=	max.	150	W
Anode input power	W_{ia}	=	max.	512	W
Negative grid voltage	$-V_g$	=	max.	300	V
Grid current	I_g	=	max.	40	mA
Grid circuit resistance with fixed grid bias	R_g	=	max.	0.1	MΩ
Grid circuit resistance with automatic grid bias	R_g	=	max.	0.2	MΩ

OPERATING CONDITIONS

Frequency	f	=	50	Mc/s
Anode voltage	V_a	=	2000	V [1]
Anode current	I_a	=	170	mA
Grid current	I_g	=	34	mA
Grid resistor	R_g	=	3750	Ω
Anode input power	W_{ia}	=	420	W
Anode dissipation	W_a	=	120	W
Grid input power	W_{ig}	=	10	W
Output power	W_o	=	290	W
Efficiency	η	=	69	%

---

[1] Mean value

7Z2 3446

R.F. CLASS C OSCILLATOR for industrial use with self-rectification. Phase shift of 180° between V_a and V_g

LIMITING VALUES (Absolute limits)

Frequency	f	up to	150	Mc/s
Anode voltage	V_a	= max.	2825	V_{RMS}
Anode current	I_a	= max.	110	mA
Anode dissipation	W_a	= max.	150	W
Anode input power	W_{ia}	= max.	340	W
Negative grid voltage	$-V_g$	= max.	300	V
Grid current	I_g	= max.	35	mA
Grid circuit resistance with fixed grid bias	R_g	= max.	0.1	MΩ
Grid circuit resistance with automatic grid bias	R_g	= max.	0.2	MΩ

OPERATING CONDITIONS

Frequency	f	=	50	Mc/s
Anode voltage	V_a	=	2500	V_{RMS}
Anode current	I_a	=	90	mA
Grid current	I_g	=	20	mA
Grid resistor	R_g	=	1700	Ω
Grid voltage	V_g	=	85	V_{RMS}
Anode input power	W_{ia}	=	255	W
Anode dissipation	W_a	=	85	W
Output power	W_o	=	170	W
Efficiency	η	=	67	%

7Z2 3447

A.F. CLASS B AMPLIFIER AND MODULATOR

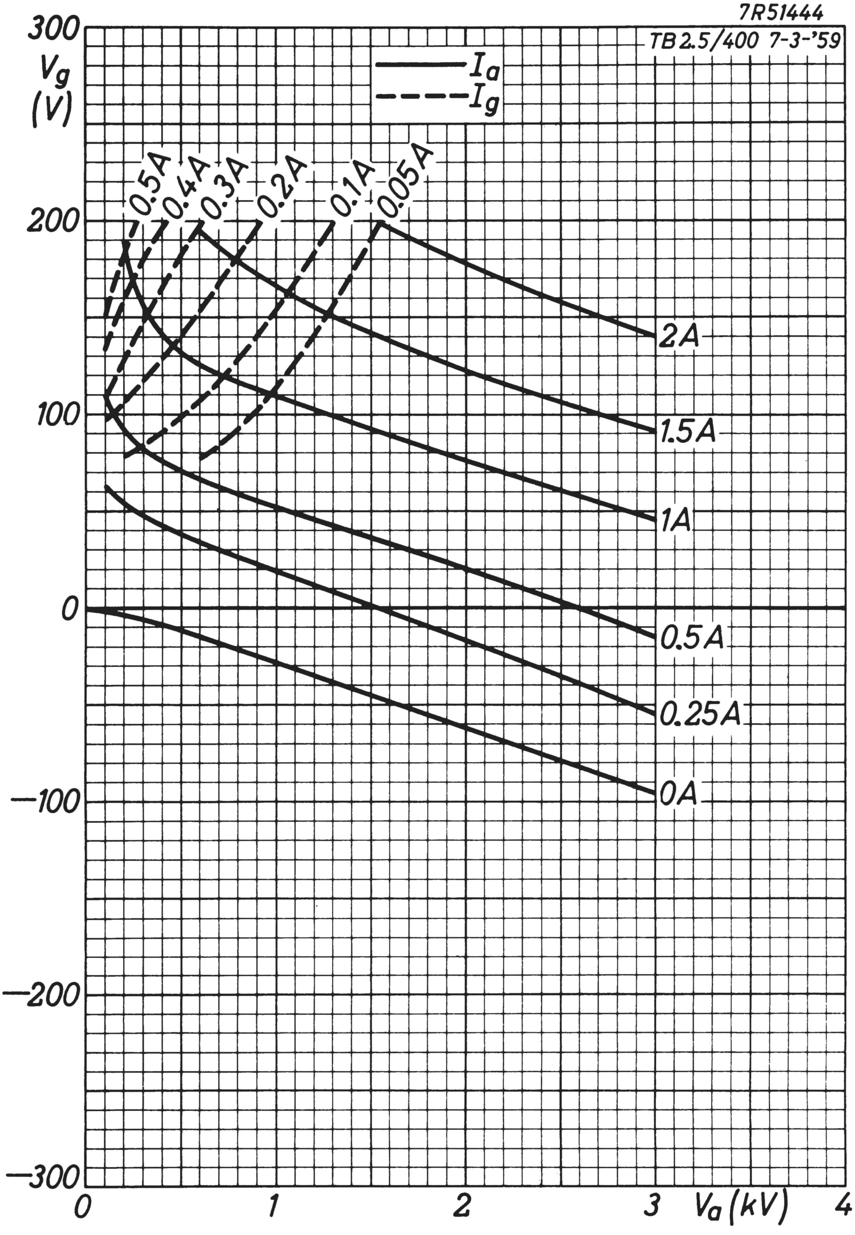
LIMITING VALUES (Absolute limits)

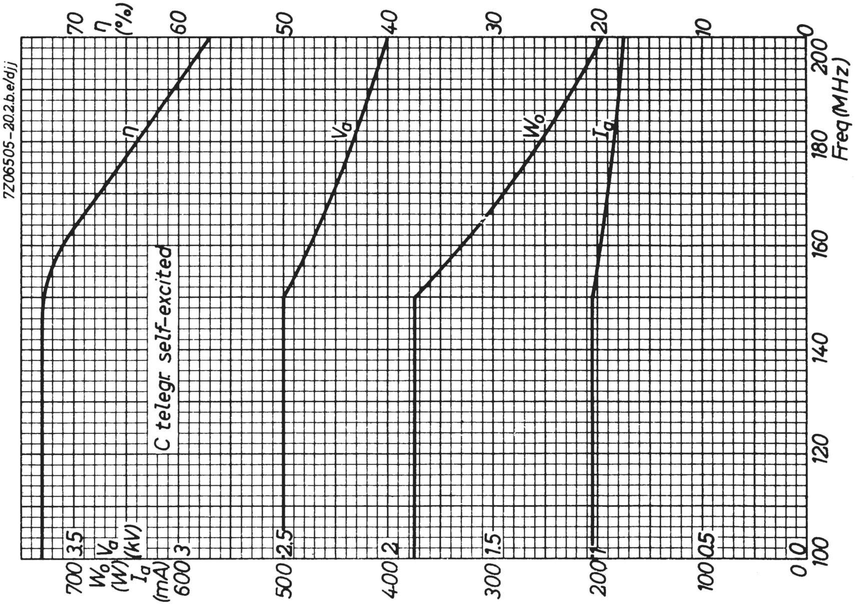
Anode voltage	V_a	=	max.	3000	V
Anode current	I_a	=	max.	210	mA
Anode dissipation	W_a	=	max.	150	W
Anode input power	W_{ia}	=	max.	512	W
Grid current	I_g	=	max.	45	mA

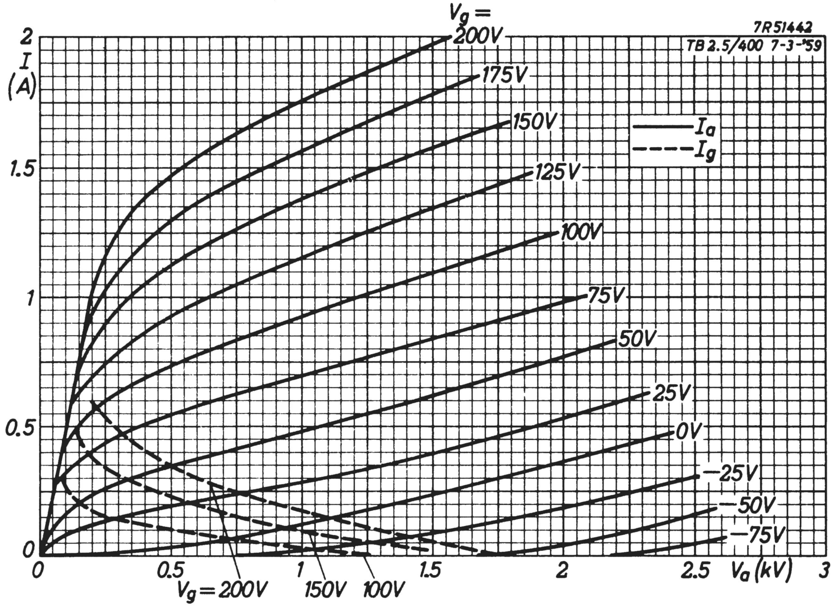
OPERATING CONDITIONS, two tubes

Anode voltage	V_a	=	2500		1000		V
Grid voltage	V_g	=	-86		-23		V
Load resistance	$R_{aa\sim}$	=	18.2		5.0		kΩ
Peak grid to grid voltage	V_{ggp}	=	0	412	0	295	V
Anode current	I_a	=	2x30	2x178	2x30	2x210	mA
Grid current	I_g	=	0	2x42	0	2x40	mA
Grid input power	W_{ig}	=	0	2x7.8	0	2x5.4	W
Anode input power	W_{ia}	=	2x75	2x445	2x30	2x210	W
Anode dissipation	W_a	=	2x75	2x95	2x30	2x73	W
Output power	W_o	=	0	700	0	274	W
Total harmonic distortion	d_{tot}	=	-	5.0	-	2.2	%
Efficiency	η	=	-	78.5	-	65	%

7Z2 3448


7R51444
TB2.5/400 7-3-'59
I_a
I_g
V_g (V)
300
200
100
0
−100
−200
−300
0.5A
0.4A
0.3A
0.2A
0.1A
0.05A
2A
1.5A
1A
0.5A
0.25A
0A
0
1
2
3
4
V_a (kV)


7Z06505-20.2.b.e/djj
C telegr. self-excited
η
Va
Wo
Ia
η (%)
70
60
50
40
30
20
10
0
Freq (MHz)
100
120
140
160
180
200
Va (kV)
3.5
3
2.5
2
1.5
1
0.5
0
Wo (W)
Ia (mA)
700
600
500
400
300
200
100
0


7R51442
TB 2.5/400 7-3-'59
Vg =
200V
175V
150V
125V
100V
75V
50V
25V
0V
−25V
−50V
−75V
Ia
Ig
I (A)
2
1.5
1
0.5
0
0
0.5
1
1.5
2
2.5
3
Va (kV)
Vg = 200V
150V
100V

R.F. POWER TRIODE

QUICK REFERENCE DATA								
Freq. (Mc/s)	C telegr.		C grounded grid		C osc.		B mod.	
	V_a (kV)	W_o (W)	V_a (kV)	W_o [1] (W)	V_a (kV)	W_o [1] (W)	V_a (kV)	W_o [1] (W)
100	4	1200			4	2320	4	1550
	3	840	3	1936	3	1626	3	1360
	2.5	750	2.5	1747			2.5	1140
	2	585	2	1374				
	1.5	425	1.5	1040				

Freq. (Mc/s)	C oscillator, industrial			
	⌒⌒		∿	
	V_a (kV)	W_o (W)	V_a (kV)	W_o (W)
50	3.5	1100	4	630
	2.25	685	3	415

HEATING: direct, parallel supply; filament thoriated tungsten

Filament voltage	V_f	=	5 V $^{+5\%}_{-10\%}$
Filament current	I_f	=	14.1 A

CAPACITANCES

Anode to all other elements except grid	C_a	=	0.16 pF
Grid to all other elements except anode	C_g	=	6.3 pF
Anode to grid	C_{ag}	=	5.0 pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	3 kV
Anode current	I_a	=	90 mA
Mutual conductance	S	=	5 mA/V
Amplification factor	μ	=	25

---

[1] Two tubes

TEMPERATURE LIMITS (Absolute limits)

Bulb temperature	t_{bulb}	= max. 350	^{o}C
Anode seal temperature	t_a	= max. 220	^{o}C
Pin temperature	t_{pin}	= max. 180	^{o}C

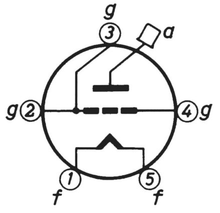
COOLING

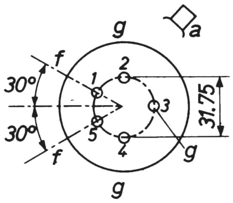
In cases where the maximum permissible temperatures are likely to be exceeded, as would normally be the case at frequencies above 30 Mc/s with full ratings, a low-velocity air flow has to be directed onto the anode seal and the bottom of the envelope. The cooling will be facilitated by the use of a blower and a glass chimney type 40666

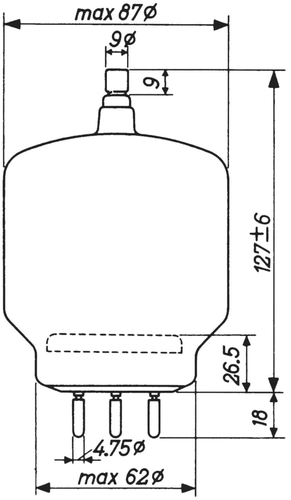
MECHANICAL DATA

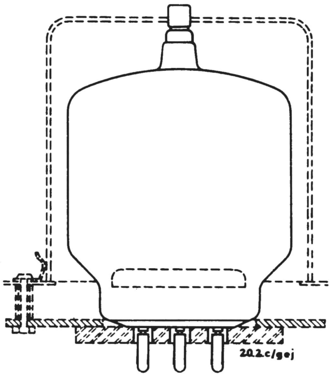
Dimensions in mm

Socket	: 2422 512 01001	Base	: Giant 5p.
Anode connector (clip)	: 40624	Net weight	: 190 g
Chimney	: 40666		









Mounting suggestion of tube with shimney

Mounting position: vertical with base up or down

In order to prevent overheating of the grid pins by high-frequency current it is recommended to include the three grid socket connections in the circuit

R.F. CLASS C TELEGRAPHY OR F.M. TELEPHONY

LIMITING VALUES (Absolute limits)

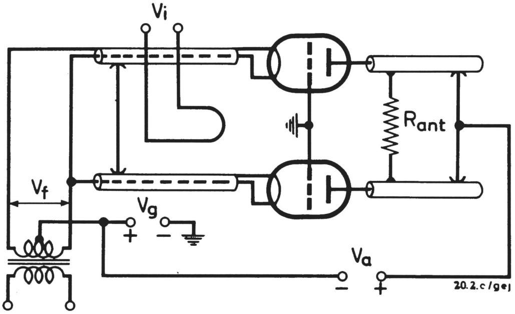
Frequency	f		up to	100	Mc/s
Anode voltage	V_a	=	max.	4	kV
Anode input power	W_{ia}	=	max.	1550	W
Anode dissipation	W_a	=	max.	350	W
Negative grid voltage	$-V_g$	=	max.	500	V
Grid dissipation	W_g	=	max.	40	W
Grid circuit resistance	R_g	=	max.	100	kΩ
Cathode current	I_k	=	max.	500	mA

OPERATING CONDITIONS

Frequency	f	=	100	100	100	100	100	Mc/s
Anode voltage	V_a	=	4	3	2.5	2	1.5	kV
Grid voltage	V_g	=	-350	-250	-200	-150	-120	V
Peak grid A.C. voltage	V_{gp}	=	535	430	380	320	295	V
Anode current	I_a	=	380	363	400	400	400	mA
Grid current	I_g	=	80	69	69	80	80	mA
Driving power	W_{dr}	=	40	27	23.5	23	21.5	W
Anode input power	W_{ia}	=	1520	1090	1000	800	600	W
Anode dissipation	W_a	=	320	250	250	215	175	W
Output power	W_o	=	1200	840	750	585	425	W
Efficiency	η	=	79	77	75	73	71	%

R.F. CLASS C TELEGRAPHY OR F.M. TELEPHONY (continued)

OPERATING CONDITIONS, grounded grid, two tubes



Frequency	f	=	100	100	100	100	Mc/s
Anode voltage	V_a	=	3	2.5	2	1.5	kV
Grid voltage	V_g	=	−250	−200	−150	−120	V
Peak grid A.C. voltage	V_{gp}	=	430	380	320	295	V
Anode current	I_a	=	726	800	800	800	mA
Grid current	I_g	=	138	138	160	160	mA
Driving power	W_{dr}	=	310	294	250	233	W
Anode input power	W_{ia}	=	2180	2000	1600	1200	W
Anode dissipation	W_a	=	500	500	430	350	W
Output power	W_o	=	1680+256	1500+247	1170+204	850+190	W 1)
Efficiency	η	=	77	75	73	71	%

---

1) Power transferred from driving stage included

R.F. CLASS C OSCILLATOR

LIMITING VALUES (Absolute limits)

Frequency	f		up to	100	Mc/s
Anode voltage	V_a	=	max.	4	kV
Anode input power	W_{ia}	=	max.	1550	W
Anode dissipation	W_a	=	max.	350	W
Negative grid voltage	$-V_g$	=	max.	500	V
Grid dissipation	W_g	=	max.	40	W
Grid circuit resistance	R_g	=	max.	100	kΩ
Cathode current	I_k	=	max.	500	mA

OPERATING CONDITIONS, two tubes

Frequency	f	=	100	100	Mc/s
Anode voltage	V_a	=	4	3	kV
Anode current	I_a	=	760	726	mA
Grid current	I_g	=	160	138	mA
Grid resistor	R_g	=	2200	1800	Ω
Driving power	W_{dr}	=	80	54	W
Anode input power	W_{ia}	=	3040	2180	W
Anode dissipation	W_a	=	640	500	W
Output power	W_o	=	2320	1626	W
Efficiency	η	=	77	75	%

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from single-phase full-wave rectifier without filter

LIMITING VALUES (Absolute limits)

Frequency	f		up to 50	up to 100	up to 150	Mc/s
Anode voltage	V_a	=	max. 3.8	max. 2.7	max. 1.8	kV
Anode input power	W_{ia}	=	max. 1500	max. 975	max. 650	W
Anode dissipation	W_a	=	max. 350	max. 350	max. 350	W
Negative grid voltage	$-V_g$	=	max. 500	max. 500	max. 500	V
Grid dissipation	W_g	=	max. 40	max. 40	max. 40	W
Grid circuit resistance	R_g	=	max. 100	max. 100	max. 100	kΩ
Cathode current	I_k	=	max. 450	max. 450	max. 450	mA

OPERATING CONDITIONS

Frequency	f	=	50	50	Mc/s
Anode voltage	V_a	=	3.5	2.25	kV
Anode current	I_a	=	325	340	mA
Grid current	I_g	=	65	60	mA
Grid resistor	R_g	=	4500	3330	Ω
Anode input power	W_{ia}	=	1400	935	W
Anode dissipation	W_a	=	300	250	W
Output power	W_o	=	1100	685	W
Efficiency	η	=	78	73	%
Output power in the load	W_ℓ	=	900	560	W

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with self rectification, 180° phase shift between V_a and V_g

LIMITING VALUES (Absolute limits)

Frequency	f		up to 50	up to 100	up to 150	Mc/s
Transformer voltage	V_{tr}	=	max. 4.5	max. 3.5	max. 2.25	kV_{RMS}
Anode input power	W_{ia}	=	max. 900	max. 730	max. 500	W
Anode dissipation	W_a	=	max. 350	max. 350	max. 350	W
Negative grid voltage	$-V_g$	=	max. 500	max. 500	max. 500	V
Grid dissipation	W_g	=	max. 40	max. 40	max. 40	W
Grid circuit resistance	R_g	=	max. 100	max. 100	max. 100	kΩ
Cathode current	I_k	=	max. 285	max. 285	max. 285	mA

OPERATING CONDITIONS

Frequency	f	=	50	50	Mc/s
Transformer voltage	V_{tr}	=	4	3	kV_{RMS}
Anode current	I_a	=	190	180	mA
Driving voltage	V_g	=	280	110	V_{RMS}
Grid current	I_g	=	35	32	mA
Grid resistor	R_g	=	5500	3000	Ω
Anode input power	W_{ia}	=	840	600	W
Anode dissipation	W_a	=	210	185	W
Output power	W_o	=	630	415	W
Efficiency	η	=	75	69	%
Output power in the load	W_{ℓ}	=	515	350	W

A.F. CLASS B AMPLIFIER AND MODULATOR two tubes in push-pull

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	= max.	4	kV
Anode input power	W_{ia}	= max.	1550	W
Anode dissipation	W_a	= max.	350	W
Negative grid voltage	$-V_g$	= max.	500	V
Grid dissipation	W_g	= max.	40	W
Grid circuit resistance	R_g	= max.	100	kΩ
Cathode current	I_k	= max.	500	mA

OPERATING CONDITIONS

V_a	=	4		3		2.5		kV
V_g	=	-135		-102		-77.5		V[1]
$R_{aa\sim}$	=	20		14.5		12		kΩ
V_{gg_p}	=	0	485	0	475	0	400	V
I_a	=	2x88	2x270	2x60	2x290	2x90	2x300	mA
I_g	=	0	2x30	0	2x60	0	2x55	mA
W_{dr}	=	0	2x7	0	2x13	0	2x10	W
W_{ia}	=	2x350	2x1080	2x180	2x870	2x225	2x750	W
W_a	=	2x350	2x305	2x180	2x190	2x225	2x180	W
W_o	=	0	1550	0	1360	0	1140	W
d_{tot}	=	–	< 2.5	–	< 2.5	–	< 2.5	%
η	=	–	71.7	–	78.1	–	76	%

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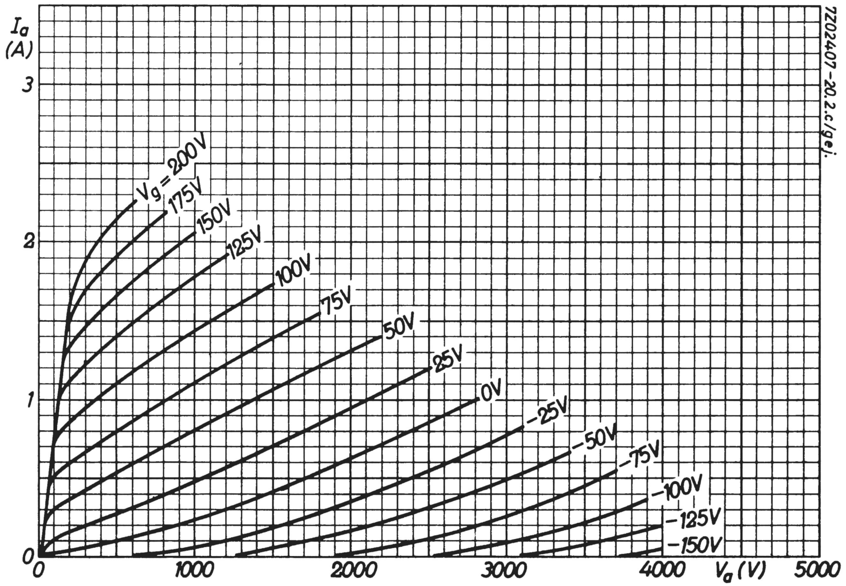
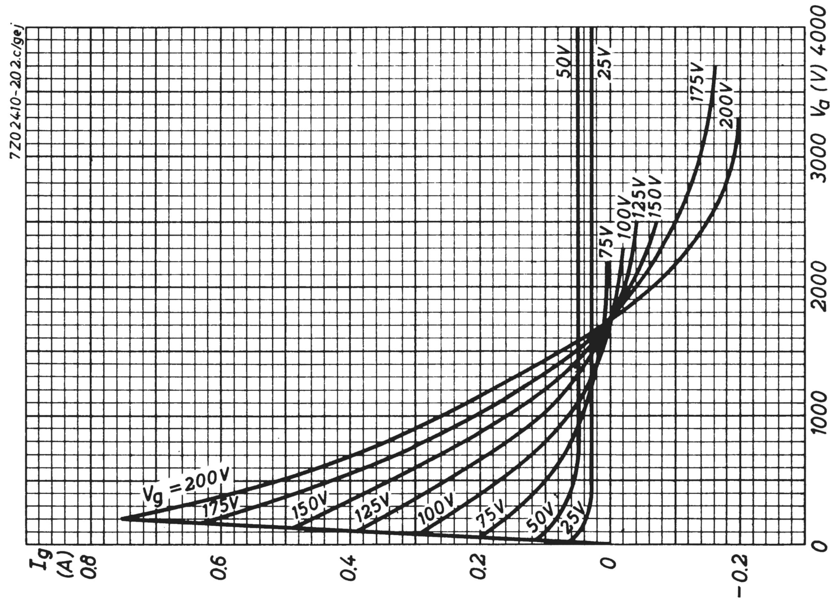
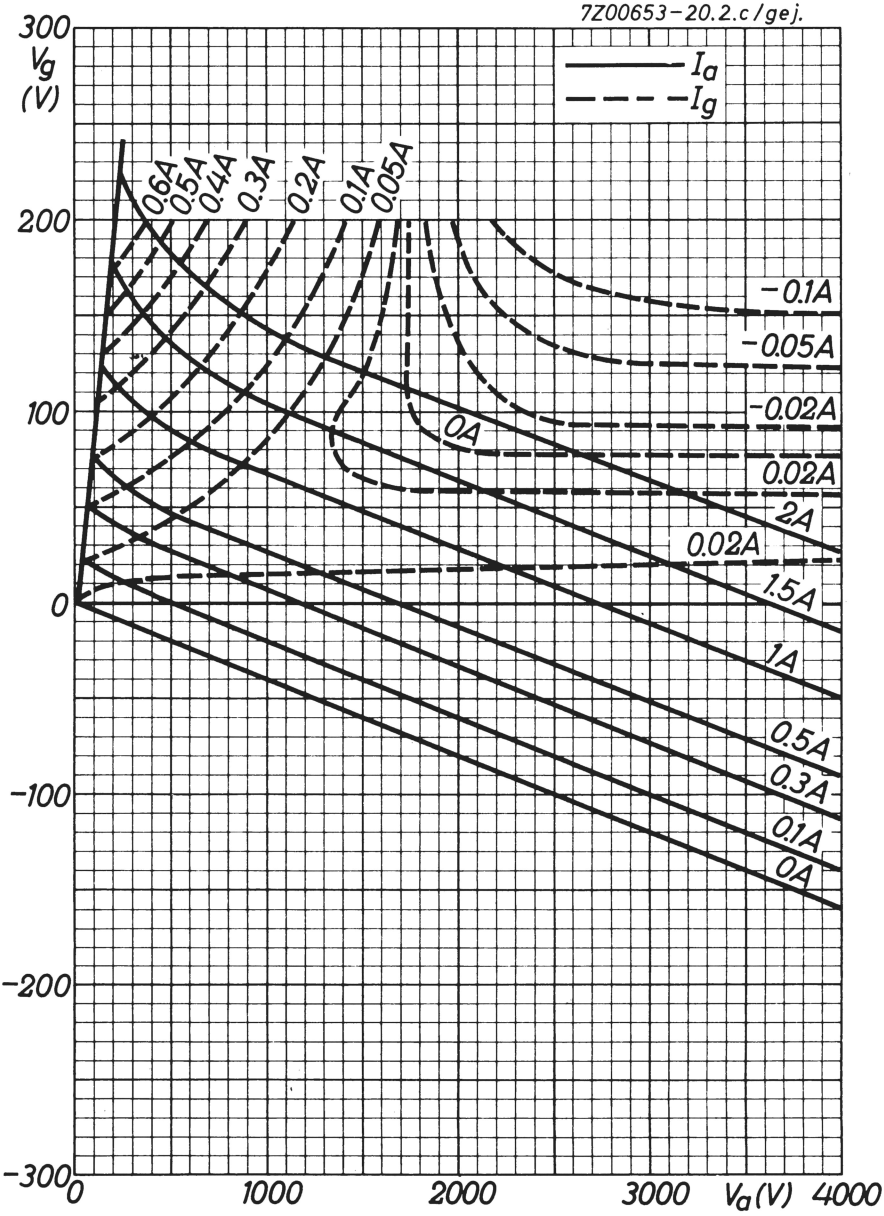
[1] To be adjusted for zero signal anode current


Ia (A)
3
2
1
0
0
1000
2000
3000
4000
Va (V)
5000
Vg = 200V
175V
150V
125V
100V
75V
50V
25V
0V
-25V
-50V
-75V
-100V
-125V
-150V
7Z02407-20.2.c/gej.


7Z02410-20.2.c/gej
Va (V)
4000
3000
2000
1000
0
Ig (A)
0.8
0.6
0.4
0.2
0
-0.2
Vg = 200V
175V
150V
125V
100V
75V
50V
25V
50V
25V
75V
100V
125V
150V
175V
200V


7Z00653-20.2.c/gej.
I_a
I_g
300
V_g
(V)
200
100
0
-100
-200
-300
0
1000
2000
3000
V_a(V)
4000
0.6A
0.5A
0.4A
0.3A
0.2A
0.1A
0.05A
-0.1A
-0.05A
-0.02A
0A
0.02A
2A
0.02A
1.5A
1A
0.5A
0.3A
0.1A
0A

R.F. POWER TRIODE

QUICK REFERENCE DATA									
λ (m)	Freq. (Mc/s)	C telegr.		C grounded grid		C_a mod.		B mod. [2]	
		V_a (V)	W_o (W)	V_a (V)	W_o[1] (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)
3	100	4000	1690	4000	1950	3000	1050	4000	2290
		3500	1430	3500	1650			3500	2440
		3000	1175	3000	1375			3000	2310
		2500	950	2500	1120			2500	2000

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	10	V
Filament current	I_f	=	9.9	A

CAPACITANCES

Anode to all other elements except grid	C_a	=	0.17	pF
Grid to all other elements except anode	C_g	=	8.0	pF
Anode to grid	C_{ag}	=	7.0	pF

TYPICAL CHARACTERISTICS

Amplification factor	μ	=	28	
Mutual conductance	S (I_a = 125 mA)	=	4.5	mA/V

TEMPERATURE LIMITS (Absolute limits)

Temperature of anode seal	=	max.	220	°C
Temperature of bottom pin seals	=	max.	180	°C
Bulb temperature	=	max.	250	°C

---

[1]) Power transferred from driving stage included
[2]) Two tubes

COOLING

In general cooling of the tube is not necessary at normal ambient temperature at frequencies below 50 Mc/s.

When the tube is used at or near the limiting values at frequencies above 50 Mc/s, it will be necessary to direct a low-velocity air flow on the anode seal and the bottom of the envelope.

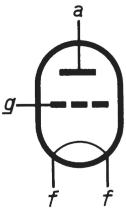
MECHANICAL DATA

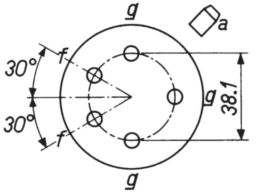
Dimensions in mm

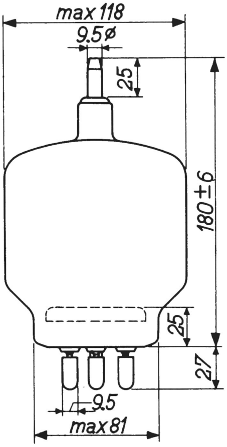
Socket : 2422 512 00001

Anode connector: 40626

Net weight : 420 g




g
a
30°
f
30°
f
g
38.1
g


max 118
9.5ø
25
180±6
25
27
9.5
max 81

Mounting position: vertical with base up or down

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

Frequency	f		up to	100	Mc/s
Anode voltage	V_a	=	max.	4000	V
Anode dissipation	W_a	=	max.	450	W
Grid dissipation	W_g	=	max.	50	W
Grid current	I_g	=	max.	115	mA
Cathode current	I_k	=	max.	650	mA

OPERATING CONDITIONS (controlled)

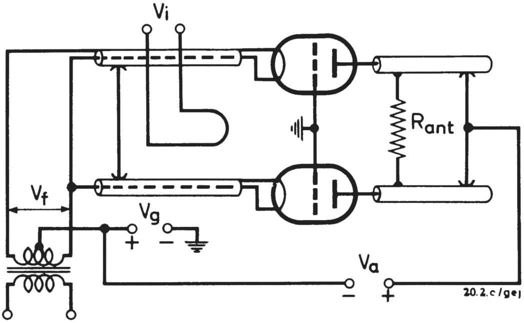
Wavelength	λ	=	3	3	3	3	m
Anode voltage	V_a	=	4000	3500	3000	2500	V
Grid voltage	V_g	=	-350	-300	-250	-200	V
Anode current	I_a	=	535	535	535	535	mA
Grid current	I_g	=	115	115	115	115	mA
Peak grid A.C. voltage	V_{gp}	=	580	520	460	405	V
Grid input power	W_{ig}	=	60	54	48	42	W
Anode input power	W_{ia}	=	2140	1880	1600	1340	W
Anode dissipation	W_a	=	450	450	425	390	W
Output power	W_o	=	1690	1430	1175	950	W
Efficiency	η	=	79	76	73.5	71	%

OPERATING CONDITIONS (self excited)

Wavelength	λ	=	3	3	3	3	m
Anode voltage	V_a	=	4000	3500	3000	2500	V
Grid resistor	R_g	=	3000	2600	2200	1800	Ω
Anode current	I_a	=	535	535	535	535	mA
Grid current	I_g	=	115	115	115	115	mA
Peak grid A.C. voltage	V_{gp}	=	580	520	460	405	V
Grid input power	W_{ig}	=	60	54	48	42	W
Anode input power	W_{ia}	=	2140	1880	1600	1340	W
Anode dissipation	W_a	=	450	450	425	390	W
Output power	W_o	=	1630	1376	1127	908	W
Efficiency	η	=	76.5	73	70.5	67.5	%

OPERATING CONDITIONS R.F. CLASS C TELEGRAPHY (continued)

Grounded grid circuit, two tubes



Wavelength	λ	=	3	3	3	3	m
Anode voltage	V_a	=	4000	3500	3000	2500	V
Grid voltage	V_g	=	−350	−300	−250	−200	V
Anode current	I_a	=	2x535	2x535	2x535	2x535	mA
Grid current	I_g	=	2x115	2x115	2x115	2x115	mA
Peak grid voltage	V_{gp}	=	580	520	460	405	V
Grid input power	W_{ig}	=	2x320	2x274	2x248	2x212	W
Anode input power	W_{ia}	=	2x2140	2x1880	2x1600	2x1340	W
Anode dissipation	W_a	=	2x450	2x450	2x425	2x390	W
Output power	W_o	=	3380+520	2860+440	2350+400	1900+340	W^{1})
Efficiency	η	=	79	76	73.5	71	%^{2})

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^{1}) Power transferred from driving stage included

^{2}) Pure tube efficiency

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

Frequency	f	up to	100	Mc/s
Anode voltage	V_a	= max.	3000	V
Anode dissipation	W_a	= max.	300	W
Grid dissipation	W_g	= max.	50	W
Grid current	I_g	= max.	115	mA
Cathode current	I_k	= max.	550	mA

OPERATING CONDITIONS

Wavelength	λ	=	3	m
Anode voltage	V_a	=	3000	V
Grid voltage	V_g	=	-375	V
Anode current	I_a	=	450	mA
Grid current	I_g	=	85	mA
Peak grid A.C. voltage	V_{gp}	=	580	V
Grid input power	W_{ig}	=	42	W
Anode input power	W_{ia}	=	1350	W
Anode dissipation	W_a	=	300	W
Output power	W_o	=	1050	W
Efficiency	η	=	78	%
Modulation factor	m	=	100	%
Modulation power	W_{mod}	=	675	W

A.F. CLASS B AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	=	max.	4000	V
Anode dissipation	W_a	=	max.	450	W
Grid dissipation	W_g	=	max.	50	W
Cathode current	I_k	=	max.	700	mA
Peak cathode current	I_{kp}	=	max.	5	A
Grid current	I_g	=	max.	130	mA
Grid circuit resistance	R_g	=	max.	50	kΩ

OPERATING CONDITIONS, two tubes

Anode voltage	V_a	=	4000		3500		V
Grid voltage	V_g	=	-135		-114		V
Load resistance	$R_{aa\sim}$	=	14.5		10.2		kΩ
Peak grid to grid voltage	V_{ggp}	=	0	566	0	563	V
Anode current	I_a	=	2x70	2x368	2x70	2x442	mA
Grid current	I_g	=	0	2x93	0	2x115	mA
Grid input power	W_{ig}	=	0	2x24	0	2x29	W
Anode input power	W_{ia}	=	2x280	2x1474	2x245	2x1550	W
Anode dissipation	W_a	=	2x280	2x329	2x245	2x330	W
Output power	W_o	=	0	2290	0	2440	W
Total distortion	d_{tot}	=	-	5	-	5	%
Efficiency	η	=	-	77.7	-	78.8	%

Anode voltage	V_a	=	3000		2500		V
Grid voltage	V_g	=	-94		-75		V
Load resistance	$R_{aa\sim}$	=	7.5		5.2		kΩ
Peak grid to grid voltage	V_{ggp}	=	0	560	0	530	V
Anode current	I_a	=	2x70	2x500	2x70	2x555	mA
Grid current	I_g	=	0	2x130	0	2x126	mA
Grid input power	W_{ig}	=	0	2x33	0	2x30	W
Anode input power	W_{ia}	=	2x210	2x1500	2x175	2x1387	W
Anode dissipation	W_a	=	2x210	2x345	2x175	2x387	W
Output power	W_o	=	0	2310	0	2000	W
Total distortion	d_{tot}	=	-	5	-	3.5	%
Efficiency	η	=	-	77	-	72	%

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from two-phase half-wave rectifier without filter

LIMITING VALUES (Absolute limits)

Frequency	f		up to	100	Mc/s
Anode voltage	V_a	=	max.	3600	V
Negative grid voltage	$-V_g$	=	max.	320	V
Anode current	I_a	=	max.	475	mA
Grid current	I_g	=	max.	100	mA
Anode input power	W_{ia}	=	max.	2200	W
Anode dissipation	W_a	=	max.	450	W
Grid dissipation	W_g	=	max.	50	W

OPERATING CONDITIONS

Transformer voltage	V_{tr}	=	4000¹)	3350²)	V_{RMS}
Anode voltage	V_a	=	3600	3000	V ³)
Anode current	I_a	=	450	400	mA
Grid current	I_g	=	100	85	mA
Grid resistor	R_g	=	3.0	3.0	kΩ
Anode input power	W_{ia}	=	2000	1480	W
Anode dissipation	W_a	=	450	400	W
Output power	W_o	=	1500	1040	W
Efficiency	η	=	75	70	%

---

1) Care must be taken that under these operating conditions the absolute limiting values are not exceeded by variation of the supply voltage or the load or by tolerances in the circuit elements.

2) Under these conditions normal deviations of voltages and load are permissible. The absolute limiting values of the tube must, however, not be exceeded.

3) D.C. value

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from three-phase half-wave rectifier without filter

LIMITING VALUES (Absolute limits)

Frequency	f		up to	100	Mc/s
Anode voltage	V_a	=	max.	4000	V
Negative grid voltage	$-V_g$	=	max.	500	V
Anode current	I_a	=	max.	535	mA
Grid current	I_g	=	max.	115	mA
Anode input power	W_{ia}	=	max.	2200	W
Anode dissipation	W_a	=	max.	450	W
Grid dissipation	W_g	=	max.	50	W

OPERATING CONDITIONS

Transformer voltage	V_{tr}	=	3400¹)	2900²)	V_{RMS}
Anode voltage	V_a	=	4000	3400	V ³)
Anode current	I_a	=	535	450	mA
Grid current	I_g	=	115	100	mA
Grid resistor	R_g	=	3.0	3.0	kΩ
Anode input power	W_{ia}	=	2140	1530	W
Anode dissipation	W_a	=	450	390	W
Output power	W_o	=	1630	1090	W
Efficiency	η	=	76.5	71	%

---

¹) Care must be taken that under these operating conditions the absolute limiting values are not exceeded by variation of the supply voltage or the load or by tolerances in the circuit elements.

²) Under these conditions normal deviations of voltages and load are permissible. The absolute limiting values of the tube must, however, not be exceeded.

³) D.C. value.

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with self rectification

LIMITING VALUES (Absolute limits)

Frequency	f		up to	100	Mc/s
Transformer voltage	V_{tr}	=	max.	4500	V_{RMS}
Negative grid voltage	$-V_g$	=	max.	500	V
Anode current	I_a	=	max.	280	mA
Grid current	I_g	=	max.	55	mA
Anode input power	W_{ia}	=	max.	1450	W
Anode dissipation	W_a	=	max.	450	W
Grid dissipation	W_g	=	max.	50	W

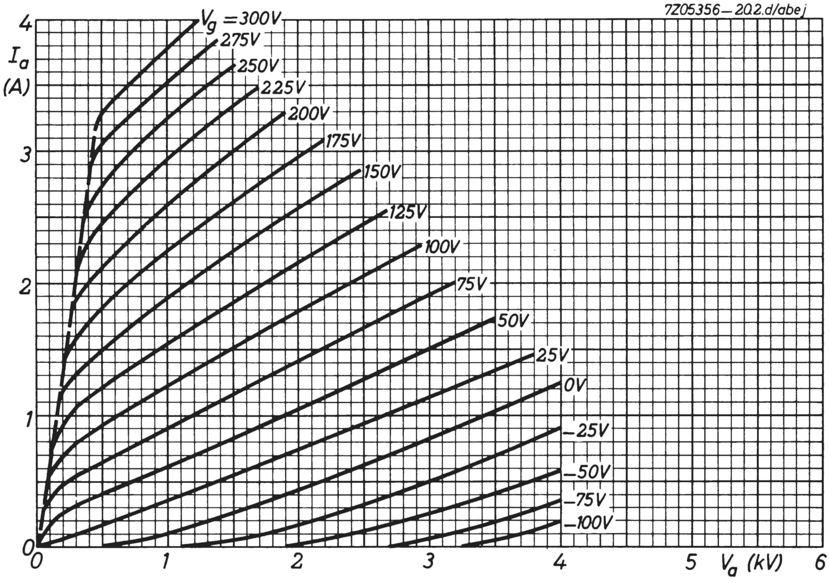
OPERATING CONDITIONS

Transformer voltage	V_{tr}	=	4500¹)	3800²)	V_{RMS}
Anode current	I_a	=	280	240	mA
Grid current	I_g	=	55	47	mA
Grid resistor	R_g	=	3.4	3.4	kΩ
Anode input power	W_{ia}	=	1400	1010	W
Anode dissipation	W_a	=	350	295	W
Output power	W_o	=	1000	670	W
Efficiency	η	=	71.5	66	%

---

1) Care must be taken that under these operating conditions the absolute limiting values are not exceeded by variation of the supply voltage or the load or by tolerances in the circuit elements.

2) Under these conditions normal deviations of voltages and load are permissible. The absolute limiting values of the tube must, however, not be exceeded.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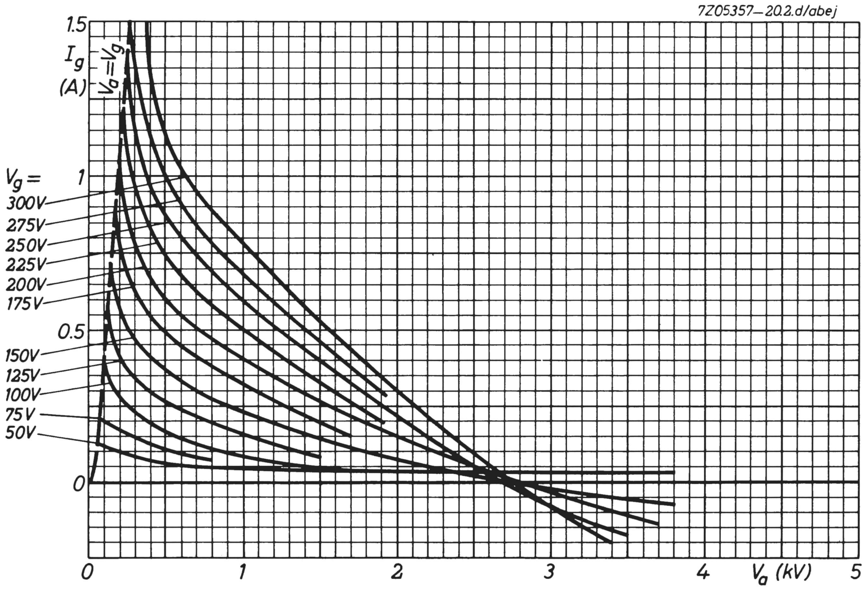
I_a
(A)
4
3
2
1
0
V_g = 300V
275V
250V
225V
200V
175V
150V
125V
100V
75V
50V
25V
0V
−25V
−50V
−75V
−100V
0
1
2
3
4
5
V_a (kV)
6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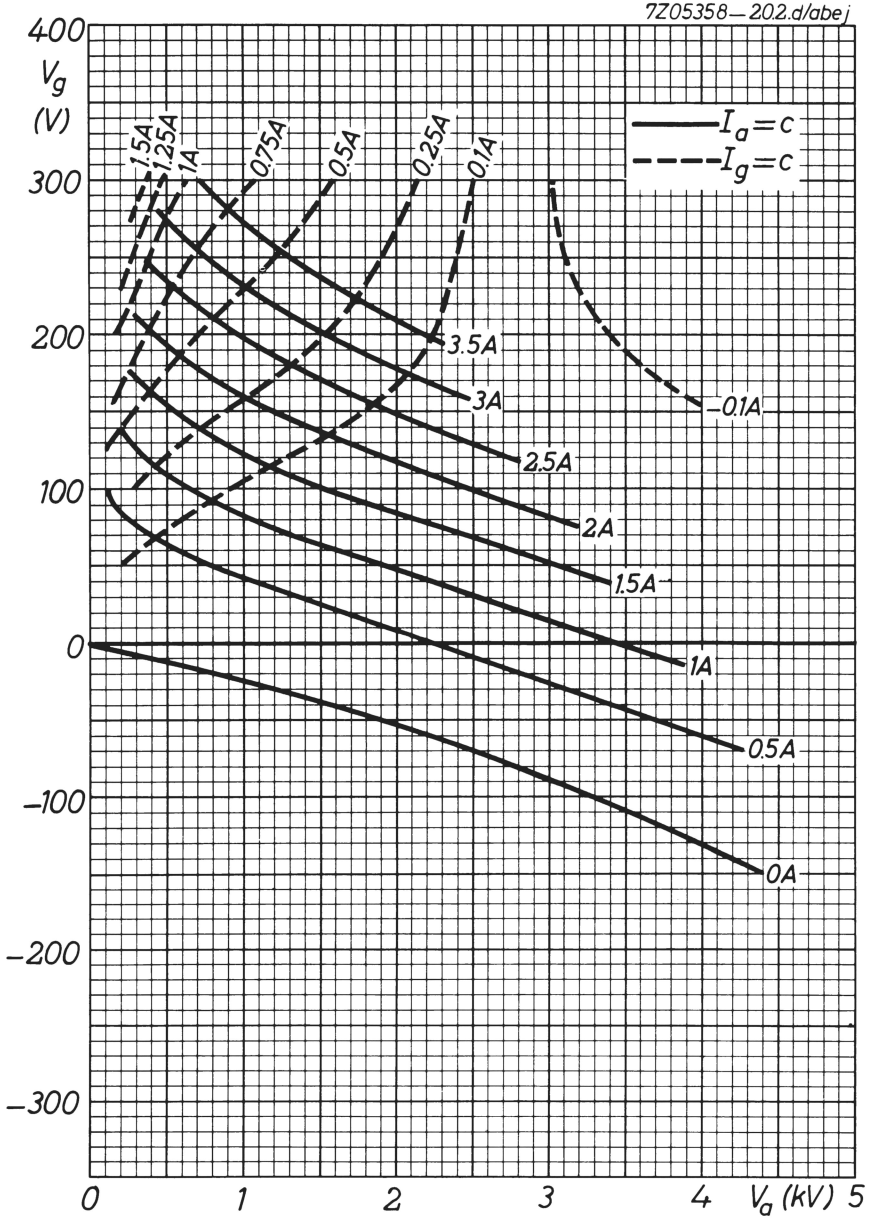
1.5
I_g
(A)
$V_a = V_g$
V_g =
1
300V
275V
250V
225V
200V
175V
0.5
150V
125V
100V
75V
50V
0
0
1
2
3
4
V_a (kV)
5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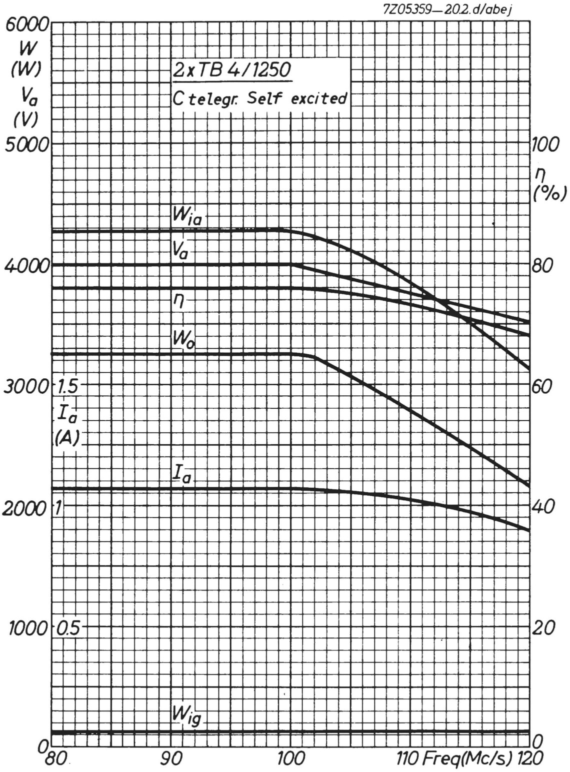
400
V_g
(V)
300
200
100
0
−100
−200
−300
$I_a = c$
$I_g = c$
1.5A
1.25A
1A
0.75A
0.5A
0.25A
0.1A
3.5A
3A
2.5A
2A
1.5A
1A
0.5A
0A
−0.1A
0
1
2
3
4
V_a (kV)
5


7Z05359—20.2.d/abej
2xTB 4/1250
C telegr. Self excited
6000
W
(W)
V_a
(V)
5000
4000
3000
2000
1000
0
1.5
I_a
(A)
1
0.5
100
η
(%)
80
60
40
20
0
W_{ia}
V_a
η
W_o
I_a
W_{ig}
80
90
100
110
Freq(Mc/s)
120

INDUSTRIAL R.F. POWER TRIODE

QUICK REFERENCE DATA

Industrial R.F. oscillator class C

Freq. (Mc/s)	three phase			single phase		A.C operation	
	V_a (V)	W_o(W)		V_a (V)	W_o(W)	V_a (V_{RMS})	W_o(W)
		CCS	ICAS		CCS		CCS
50	6000	1640	3200	5400	1635	4500	1020
	5000	1670	2400	4500	1600		
	4000	1650					

HEATING: direct; filament thoriated tungsten

Filament voltage V_f = 5.0 V $^{+5\%}_{-10\%}$

Filament current I_f = 32.5 A

CAPACITANCES

Anode to all other elements except grid C_a = 0.2 pF

Grid to all other elements except anode C_g = 7.5 pF

Anode to grid C_{ag} = 5.1 pF

TYPICAL CHARACTERISTICS

Anode voltage V_a = 4000 V

Anode current I_a = 120 mA

Amplification factor μ = 21

Mutual conductance S = 3.3 mA/V

TEMPERATURE LIMITS (Absolute limits)

Temperature of all seals = max. 220 °C

Bulb temperature = max. 350 °C

COOLING

In general cooling of the tube working at the published operating conditions with matched load is not necessary. When the tube is mounted in a small cabinet adequate ventilation must be provided.

At non-matched load, combined with the highest operating frequencies a low-velocity air flow on the tube is necessary. A small fan will suffice; it is recommended to mount the fan underneath the tube socket.

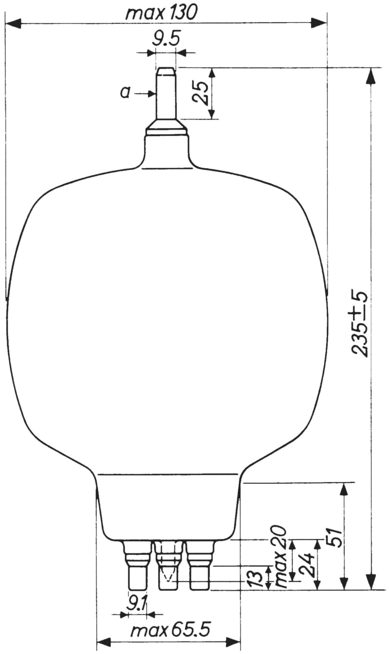
MECHANICAL DATA

Dimensions in mm

Socket : 2422 511 05001

Anode connector: 40665

Net weight : 450 g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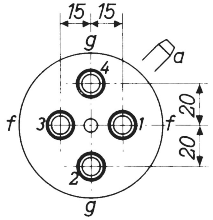
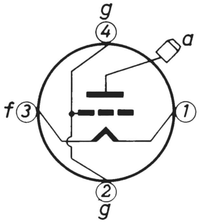
a
25
235±5
51
max 20
24
13
9.1
max 65.5


15
15
g
a
4
f
3
1
f
20
20
2
g



Mounting position: vertical

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from three-phase rectifier.

C.C.S. LIMITING VALUES (Absolute limits), continuous service

Frequency	f		up to	50	Mc/s
Anode voltage	V_a	=	max.	7000	V
Anode current	I_a	=	max.	560	mA
Anode input power	W_{ia}	=	max.	2500	W
Anode dissipation	W_a	=	max.	500	W
Negative grid voltage	$-V_g$	=	max.	1250	V
Grid current, loaded	I_g	=	max.	210	mA
Grid current, unloaded	I_g	=	max.	280	mA
Grid circuit resistance	R_g	=	max.	15	kΩ

C.C.S. OPERATING CONDITIONS, continuous service

Frequency	f	=	50	50	50	Mc/s
Anode voltage	V_a	=	6000	5000	4000	V
Anode current, loaded	I_a	=	350	430	535	mA
Anode current, unloaded	I_a	=	90	100	150	mA
Grid current, loaded	I_g	=	120	130	150	mA
Grid current, unloaded	I_g	=	180	200	225	mA
Grid resistor	R_g	=	4200	3500	2700	Ω
Load resistance	$R_{a\sim}$	=	9000	6400	3800	Ω
Feedback ratio under loaded conditions	$V_{g\sim}/V_{a\sim}$	=	15	15.5	20	%
Anode input power	W_{ia}	=	2100	2150	2140	W
Anode dissipation	W_a	=	460	480	490	W
Output power	W_o	=	1640	1670	1650	W
Efficiency	η	=	78	77.5	77	%
Output power in the load	W_ℓ	=	1300	1350	1325	W 1)

---

1) Useful power in the load measured in a circuit having an efficiency of 85%.

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from three-phase rectifier.

I.C.A.S. LIMITING VALUES (Absolute limits), intermittent service

Frequency	f		up to	50	Mc/s
Anode voltage	V_a	=	max.	7000	V
Anode current	I_a	=	max.	750	mA
Anode input power	W_{ia}	=	max.	5000	W
Anode dissipation	W_a		See page 8		
Negative grid voltage	$-V_g$	=	max.	1250	V
Grid current, loaded	I_g	=	max.	185	mA
Grid current, unloaded	I_g	=	max.	300	mA
Grid circuit resistance	R_g	=	max.	15	kΩ

I.C.A.S. OPERATING CONDITIONS, intermittent service

Frequency	f	=	50	50	Mc/s
Anode voltage	V_a	=	6000	5000	V
Anode current, loaded	I_a	=	700	630	mA
Anode current, unloaded	I_a	=	130	150	mA
Grid current, loaded	I_g	=	170	160	mA
Grid current, unloaded	I_g	=	290	280	mA
Grid resistor	R_g	=	3300	2700	Ω
Load resistance	$R_{a\sim}$	=	6500	4500	Ω
Feedback ratio under loaded conditions	$V_{g\sim}/V_{a\sim}$	=	16	17	%
Anode input power	W_{ia}	=	4200	3150	W
Anode dissipation	W_a	=	1000	750	W
Output power	W_o	=	3200	2400	W
Efficiency	η	=	76	76	%
Output power in the load	W_ℓ	=	2650	1950	W 1)

---

1) Useful power in the load measured in a circuit having an efficiency of 85%.

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from single-phase rectifier without filter

C.C.S. LIMITING VALUES (Absolute limits), continuous service

Frequency	f		up to	50	Mc/s
Anode voltage	V_a	=	max.	6300	V
Anode current	I_a	=	max.	500	mA
Anode input power	W_{ia}	=	max.	2500	W
Anode dissipation	W_a	=	max.	500	W
Negative grid voltage	$-V_g$	=	max.	1250	V
Grid current, loaded	I_g	=	max.	185	mA
Grid current, unloaded	I_g	=	max.	280	mA
Grid circuit resistance	R_g	=	max.	15	kΩ

C.C.S. OPERATING CONDITIONS, continuous service

Frequency	f	=	50	50	Mc/s
Anode voltage	V_a	=	5400	4500	V
Anode current, loaded	I_a	=	320	380	mA
Anode current, unloaded	I_a	=	80	90	mA
Grid current, loaded	I_g	=	110	120	mA
Grid current, unloaded	I_g	=	170	190	mA
Grid resistor	R_g	=	4200	3500	Ω
Load resistance	$R_{a\sim}$	=	9	6.4	kΩ
Feedback ratio under loaded conditions	$V_{g\sim}/V_{a\sim}$	=	13	15.5	%
Anode input power	W_{ia}	=	2125	2100	W
Anode dissipation	W_a	=	490	500	W
Output power	W_o	=	1635	1600	W
Efficiency	η	=	77	76	%
Output power in the load	W_ℓ	=	1350	1300	W [1]

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[1] Useful power in the load measured in a circuit having an efficiency of 85%.

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with self-rectification.

C.C.S. **LIMITING VALUES** (Absolute limits), continuous service

Frequency	f		up to	50	Mc/s
Transformer voltage	V_{tr}	=	max.	5000	V_{RMS}
Anode current	I_a	=	max.	320	mA [1]
Anode input power	W_{ia}	=	max.	1600	W
Anode dissipation	W_a	=	max.	500	W
Negative grid voltage	$-V_g$	=	max.	1350	V [2]
Grid current, loaded	I_g	=	max.	110	mA [1]
Grid current, unloaded	I_g	=	max.	150	mA [1]
Grid circuit resistance	R_g	=	max.	15	kΩ

C.C.S. **OPERATING CONDITIONS**, continuous service

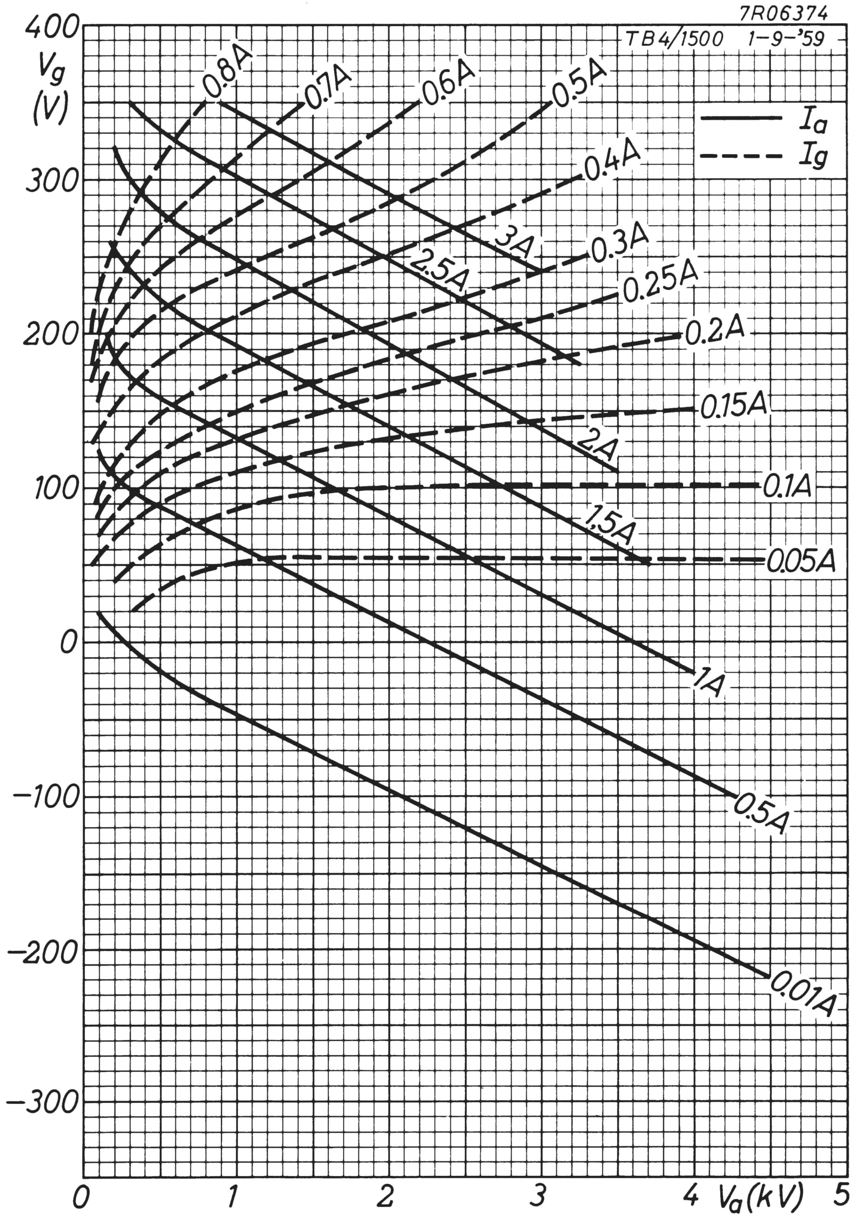
Frequency	f	=	50	Mc/s
Transformer voltage	V_{tr}	=	4500	V_{RMS}
Anode current, loaded	I_a	=	280	mA [1]
Anode current, unloaded	I_a	=	70	mA [1]
Grid current, loaded	I_g	=	80	mA [1]
Grid current, unloaded	I_g	=	125	mA [1]
Grid resistor	R_g	=	2700	Ω
Load resistance	$R_{a\sim}$	=	3300	Ω
Feedback ratio under loaded conditions	$V_{g\sim}/V_{a\sim}$	=	18	%
Anode input power	W_{ia}	=	1400	W
Anode dissipation	W_a	=	380	W
Output power	W_o	=	1020	W
Efficiency	η	=	73	%
Output power in the load	W_ℓ	=	820	W [3]

---

[1] Averaged over any mains frequency cycle

[2] At peak of mains frequency sine-wave

[3] Useful power in the load measured in a circuit having an efficiency of 85%.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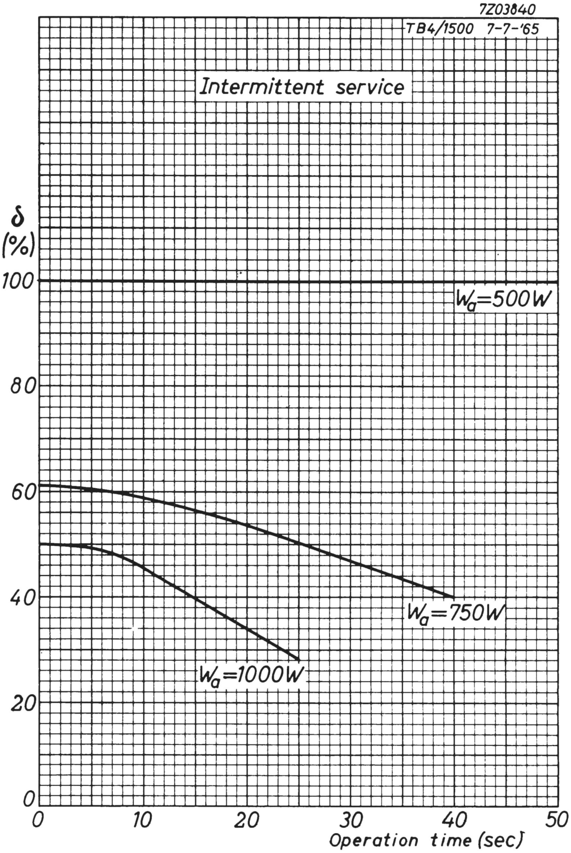
300
200
100
0
−100
−200
−300
V_g (V)
0
1
2
3
4
5
V_a(kV)
I_a
I_g
0.8A
0.7A
0.6A
0.5A
0.4A
0.3A
0.25A
0.2A
0.15A
0.1A
0.05A
3A
2.5A
2A
1.5A
1A
0.5A
0.01A


7Z03840
TB4/1500 7-7-'65
Intermittent service
δ
(%)
100
80
60
40
20
0
0
10
20
30
40
50
Operation time (sec)
W_a=500W
W_a=750W
W_a=1000W

INDUSTRIAL R.F. POWER TRIODE

QUICK REFERENCE DATA

Industrial R.F. oscillator class C

Freq. (Mc/s)	three phase			single phase		A.C. operation	
	V_a (V)	W_o(W)		V_a (V)	W_o(W)	V_a (V_{RMS})	W_o(W)
		CCS	ICAS		CCS		CCS
50	6000	2840	4400	5400	2750	5200	1560
	5000	2720	3375	4500	2550		
	4000	2160					
	3000	1560					

HEATING: direct; filament thoriated tungsten

Filament voltage V_f = 6.3 V $^{+5\,\%}_{-10\,\%}$

Filament current I_f = 32.5 A

CAPACITANCES

Anode to all other elements except grid C_a = 0.25 pF

Grid to all other elements except anode C_g = 10.5 pF

Anode to grid C_{ag} = 6.2 pF

TYPICAL CHARACTERISTICS

Anode voltage V_a = 4 kV

Anode current I_a = 190 mA

Amplification factor μ = 22

Mutual conductance S = 5.1 mA/V

TEMPERATURE LIMITS (Absolute limits)

Temperature of seals = max. 220 °C

Bulb temperature = max. 350 °C

COOLING

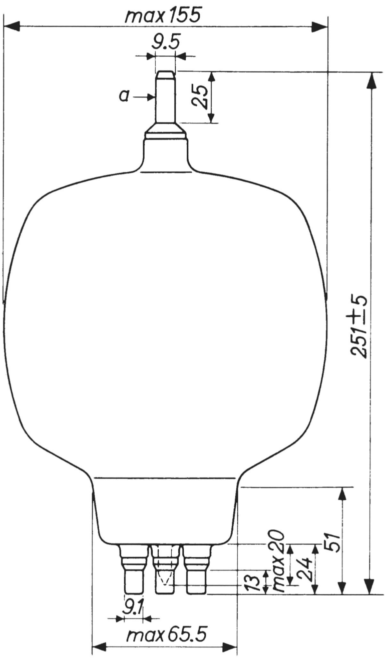
In general cooling of the tube is not necessary at matched load. When the tube is mounted in a small cabinet adequate ventilation must be provided.

At non-matched load or at high anode voltages, combined with the highest operating frequencies a low-velocity air flow directed on the tube is necessary. A small fan will suffice; it is recommended to mount the fan underneath the tube socket.

MECHANICAL DATA

Dimensions in mm

Socket	:	2422 511 05001
Anode connector:		40665
Net weight	:	600 g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max 20
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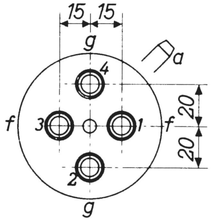
13
9.1
max 65.5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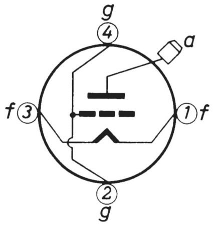
f
20
20
2
g



Mounting position: vertical

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from three-phase rectifier

C.C.S. LIMITING VALUES (Absolute limits), continuous service

Frequency	f		up to	50	Mc/s
Anode voltage	V_a	=	max.	7000	V
Anode current	I_a	=	max.	750	mA
Anode input power	W_{ia}	=	max.	4000	W
Anode dissipation	W_a	=	max.	800	W
Negative grid voltage	$-V_g$	=	max.	1250	V
Grid current, loaded	I_g	=	max.	300	mA
Grid current, unloaded	I_g	=	max.	400	mA
Grid circuit resistance	R_g	=	max.	10	kΩ

C.C.S. OPERATING CONDITIONS, continuous service

Recommended grid blocking capacitor: at high frequencies about 100 pF
at about 1 Mc/s about 1000 pF

Frequency	f	=	50	50	50	50	Mc/s
Anode voltage	V_a	=	6000	5000	4000	3000	V
Anode current, loaded	I_a	=	600	700	700	700	mA
Anode current, unloaded	I_a	=	120	150	170	200	mA
Grid current, loaded	I_g	=	150	160	180	200	mA
Grid current, unloaded	I_g	=	260	280	300	340	mA
Grid resistor	R_g	=	3	2.5	2	1.5	kΩ
Load resistance	$R_{a\sim}$	=	5.4	3.8	3	2.25	kΩ
Feedback ratio under loaded conditions	$V_{g\sim}/V_{a\sim}$	=	13	17	20	25	%
Anode input power	W_{ia}	=	3600	3500	2800	2100	W
Anode dissipation	W_a	=	760	780	640	540	W
Output power	W_o	=	2840	2720	2160	1560	W
Efficiency	η	=	79	78	77	74	%
Output power in the load	W_ℓ	=	2350	2250	1750	1250	W 1)

---

1) Useful power in the load measured in a circuit having an efficiency of 85%.

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from three-phase rectifier.

I.C.A.S. **LIMITING VALUES** (Absolute limits), intermittent service

Frequency	f		up to	50	Mc/s
Anode voltage	V_a	=	max.	7000	V
Anode current	I_a	=	max.	1000	mA
Anode input power	W_{ia}	=	max.	7000	W
Anode dissipation	W_a		See page 8		
Negative grid voltage	$-V_g$	=	max.	1250	V
Grid current, loaded	I_g	=	max.	300	mA
Grid current, unloaded	I_g	=	max.	400	mA
Grid circuit resistance	R_g	=	max.	10	kΩ

I.C.A.S. **OPERATING CONDITIONS**, intermittent service

Frequency	f	=	50	50	Mc/s
Anode voltage	V_a	=	6000	5000	V
Anode current, loaded	I_a	=	950	900	mA
Anode current, unloaded	I_a	=	180	200	mA
Grid current, loaded	I_g	=	190	190	mA
Grid current, unloaded	I_g	=	390	390	mA
Grid resistor	R_g	=	2500	2000	Ω
Load resistance	$R_{a\sim}$	=	3200	2700	Ω
Feedback ratio under loaded conditions	$V_{g\sim}/V_{a\sim}$	=	17	20	%
Anode input power	W_{ia}	=	5700	4500	W
Anode dissipation	W_a	=	1300	1125	W
Output power	W_o	=	4400	3375	W
Efficiency	η	=	77	75	%
Output power in the load	W_ℓ	=	3600	2800	W 1)

---

1) Useful power in the load measured in a circuit having an efficiency of 85%.

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from single-phase rectifier without filter.

C.C.S. LIMITING VALUES (Absolute limits), continuous service

Frequency	f		up to	50	Mc/s
Anode voltage	V_a	=	max.	6300	V
Anode current	I_a	=	max.	670	mA
Anode input power	W_{ia}	=	max.	4000	W
Anode dissipation	W_a	=	max.	800	W
Negative grid voltage	$-V_g$	=	max.	1250	V
Grid current, loaded	I_g	=	max.	270	mA
Grid current, unloaded	I_g	=	max.	400	mA
Grid circuit resistance	R_g	=	max.	10	kΩ

C.C.S. OPERATING CONDITIONS, continuous service

Frequency	f	=	50	50	Mc/s
Anode voltage	V_a	=	5400	4500	V
Anode current, loaded	I_a	=	530	600	mA
Anode current, unloaded	I_a	=	100	120	mA
Grid current, loaded	I_g	=	140	150	mA
Grid current, unloaded	I_g	=	240	260	mA
Grid resistor	R_g	=	3	2.5	kΩ
Load resistance	$R_{a\sim}$	=	5.4	3.8	kΩ
Feedback ratio under loaded conditions	$V_{g\sim}/V_{a\sim}$	=	13	15.5	%
Anode input power	W_{ia}	=	3520	3320	W
Anode dissipation	W_a	=	770	770	W
Output power	W_o	=	2750	2550	W
Efficiency	η	=	78	77	%
Output power in the load	W_ℓ	=	2250	2100	W [1]

---

[1] Useful power in the load measured in a circuit having an efficiency of 85%.

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with selfrectification.

C.C.S. **LIMITING VALUES** (Absolute limits), continuous service

Frequency	f		up to	50	Mc/s
Transformer voltage	V_{tr}	=	max.	5600	V_{RMS}
Anode current	I_a	=	max.	400	mA 1)
Anode input power	W_{ia}	=	max.	2250	W
Anode dissipation	W_a	=	max.	800	W
Negative grid voltage	$-V_g$	=	max.	1250	V 2)
Grid current, loaded	I_g	=	max.	160	mA 1)
Grid current, unloaded	I_g	=	max.	210	mA 1)
Grid circuit resistance	R_g	=	max.	10	kΩ

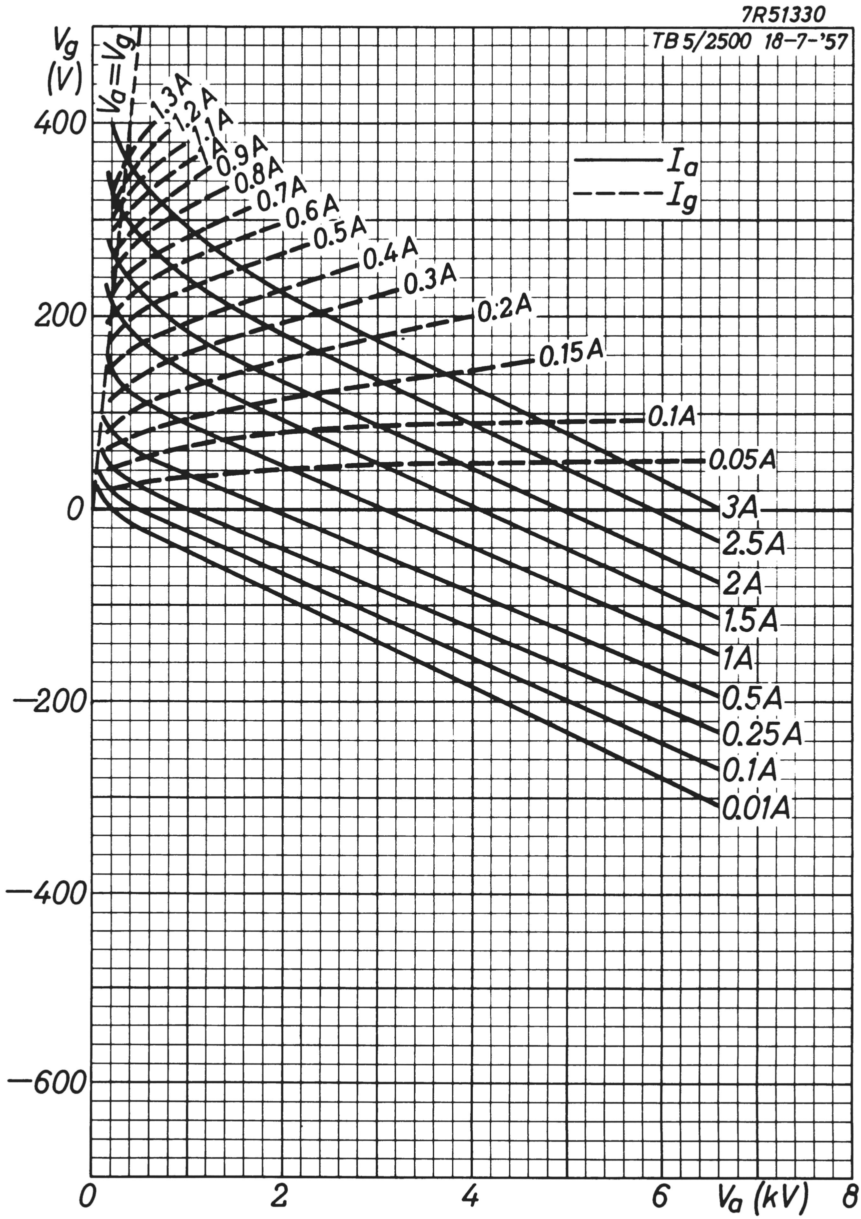
C.C.S. **OPERATING CONDITIONS**, continuous service

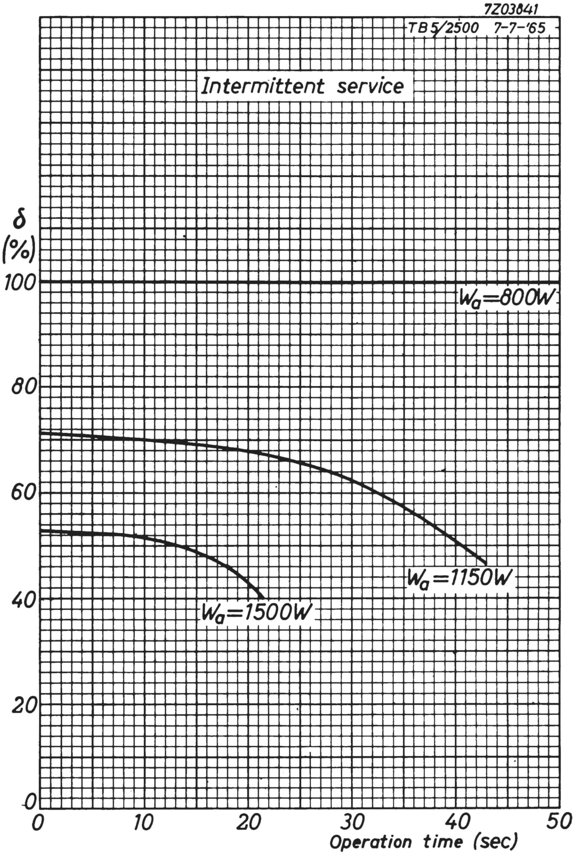
Recommended grid blocking capacitor: at high frequencies about 100 pF
at about 1 Mc/s about 1000 pF

Frequency	f	=	50	Mc/s
Transformer voltage	V_{tr}	=	5200	V_{RMS}
Anode current, loaded	I_a	=	360	mA 1)
Anode current, unloaded	I_a	=	90	mA 1)
Grid current, loaded	I_g	=	100	mA 1)
Grid current, unloaded	I_g	=	140	mA 1)
Grid resistor	R_g	=	1.8	kΩ
Load resistance	$R_{a\sim}$	=	3.2	kΩ
Feedback ratio under loaded conditions	$V_{g\sim}/V_{a\sim}$	=	17	%
Anode input power	W_{ia}	=	2080	W
Anode dissipation	W_a	=	520	W
Output power	W_o	=	1560	W
Efficiency	η	=	75	%
Output power in the load	W_ℓ	=	1300	W 3)

---

1) Averaged over any mains frequency cycle
2) At peak of mains frequency sine-wave
3) Useful power in the load measured in a circuit having an efficiency of 85%.


7R51330
TB 5/2500 18-7-'57
Vg (V)
400
200
0
−200
−400
−600
0
2
4
6
Va (kV)
8
Va=Vg
Ia
Ig
1.3A
1.2A
1.1A
1A
0.9A
0.8A
0.7A
0.6A
0.5A
0.4A
0.3A
0.2A
0.15A
0.1A
0.05A
3A
2.5A
2A
1.5A
1A
0.5A
0.25A
0.1A
0.01A


7Z03841
TB5/2500 7-7-'65
Intermittent service
δ
(%)
100
80
60
40
20
0
W_a=800W
W_a=1150W
W_a=1500W
0
10
20
30
40
50
Operation time (sec)

WATER COOLED INDUSTRIAL R.F. POWER TRIODE WITH INTEGRAL HELICAL COOLER

QUICK REFERENCE DATA		
Industrial R.F. oscillator class C		
Freq. (Mc/s)	three phase	
	V_a (kV)	W_o (kW)
30	7 6	17.7 14.3

HEATING: direct, filament thoriated tungsten

Filament voltage V_f = 6.3 V $^{+5\%}_{-10\%}$

Filament current I_f = 130 A

Cold filament resistance R_{fo} = 0.005 Ω

The filament current must never exceed a peak value of 280 A at any time during the initial energizing schedule

CAPACITANCES

Anode to all other elements except grid C_a = 1.2 pF

Grid to all other elements except anode C_g = 44.5 pF

Anode to grid C_{ag} = 33.5 pF

TYPICAL CHARACTERISTICS

Anode voltage V_a = 6 kV

Anode current I_a = 2.5 A

Mutual conductance S = 23 mA/V

Amplification factor μ = 17.5

TEMPERATURE LIMITS (Absolute limits)

Temperature of all seals = max. 220 °C

WATER COOLING CHARACTERISTICS

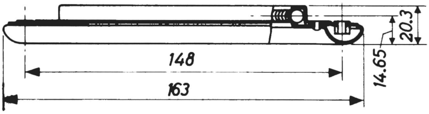
W_a (kW)	t_i (^oC)	q_{min} (l/min)	p_i (atm)	t_o (^oC)
5	20	2.3	0.02	56
	50	4.6	0.07	68
10	20	4.5	0.06	55
	50	9.0	0.21	67
15	20	7.0	0.14	53
	50	14.0	0.45	66

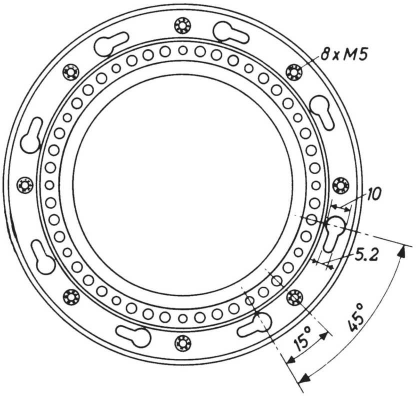
Water inlet temperature t_i = max. 50 ^oC

At water inlet temperatures between 20 ^oC and 50 ^oC the required quantity of water can be found by linear interpolation

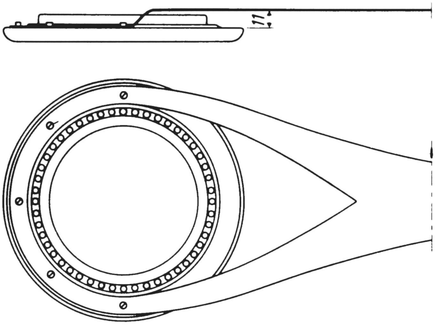
MECHANICAL DATA

Dimensions in mm





Grid connector 40664

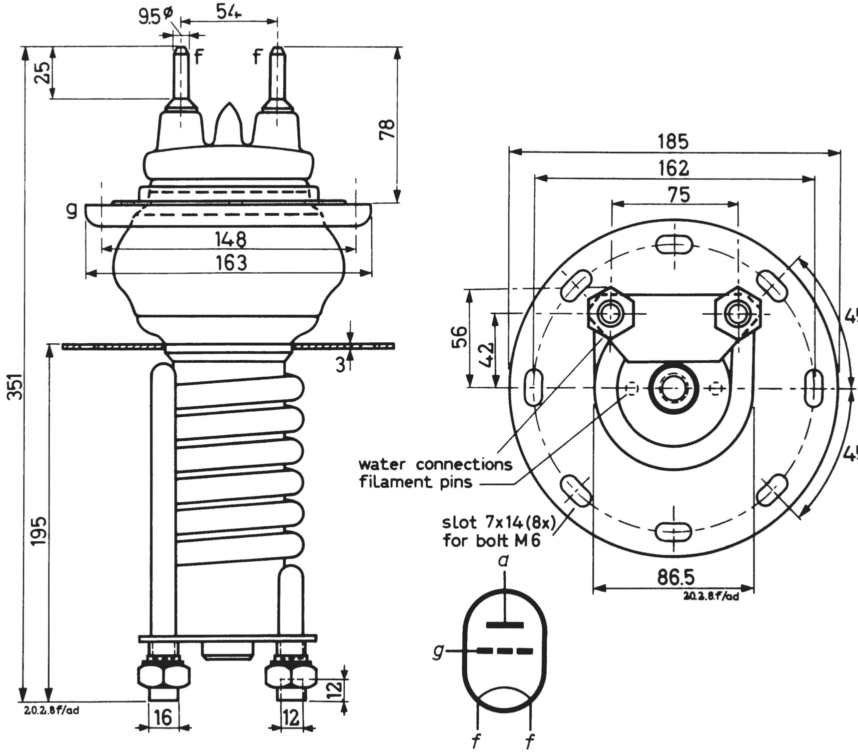


Connection of the grid lead

The rounded side of the grid connector should face the anode. To ensure a uniform R.F. current distribution in the grid seal at frequencies higher than 4 Mc/s, the grid lead should be connected as shown in the figure at right

MECHANICAL DATA (continued) Dimensions in mm

Filament connectors with cable	40662	Net weight 3.8 kg
Grid connector	40664	


9.5⌀
54
f
f
25
78
g
148
163
351
195
3
16
12
12
20.2.8f/ad
185
162
75
56
42
45°
45°
water connections
filament pins
slot 7x14(8x)
for bolt M6
86.5
20.2.8f/ad
a
g
f
f

Mounting position: vertical with anode down

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from three-phase rectifier without filter

LIMITING VALUES (Absolute limits)

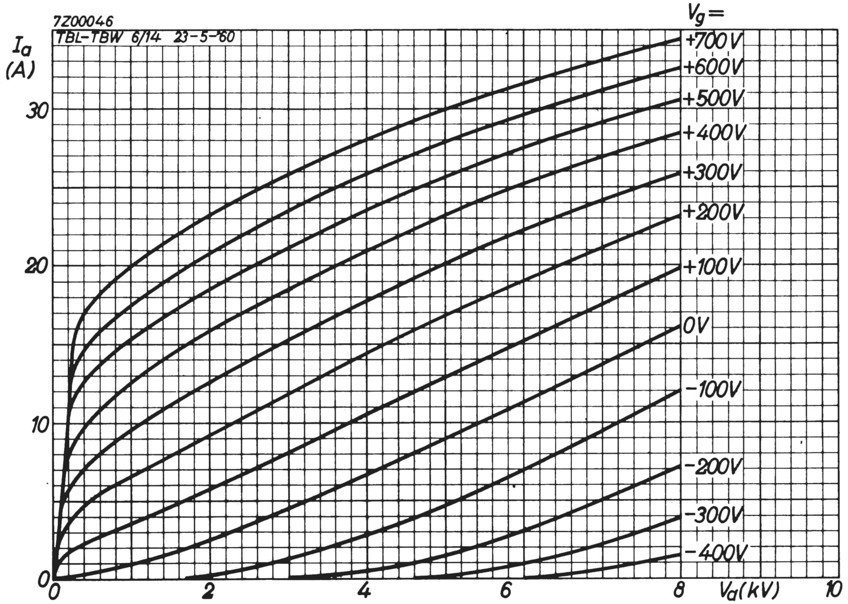
Frequency	f	up to	30	MHz
Anode voltage	V_a	max.	8	kV
Anode input power	W_{ia}	max.	30	kW
Anode dissipation	W_a	max.	15	kW
Anode current	I_a	max.	4.0	A
Negative grid voltage	$-V_g$	max.	1600	V
Grid current, loaded	I_g	max.	1.5	A
Grid current, unloaded	I_g	max.	2.0	A
Grid circuit resistance	R_g	max.	10	kΩ

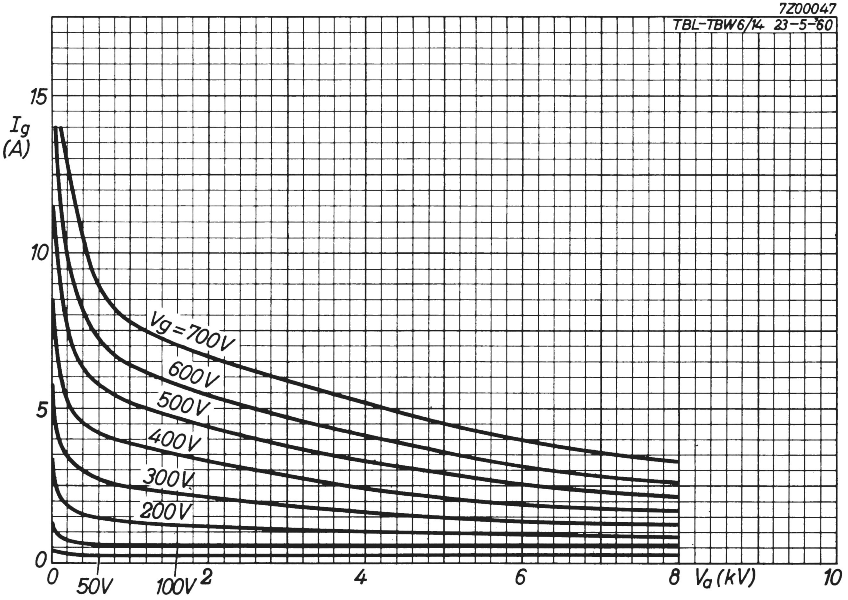
OPERATING CONDITIONS

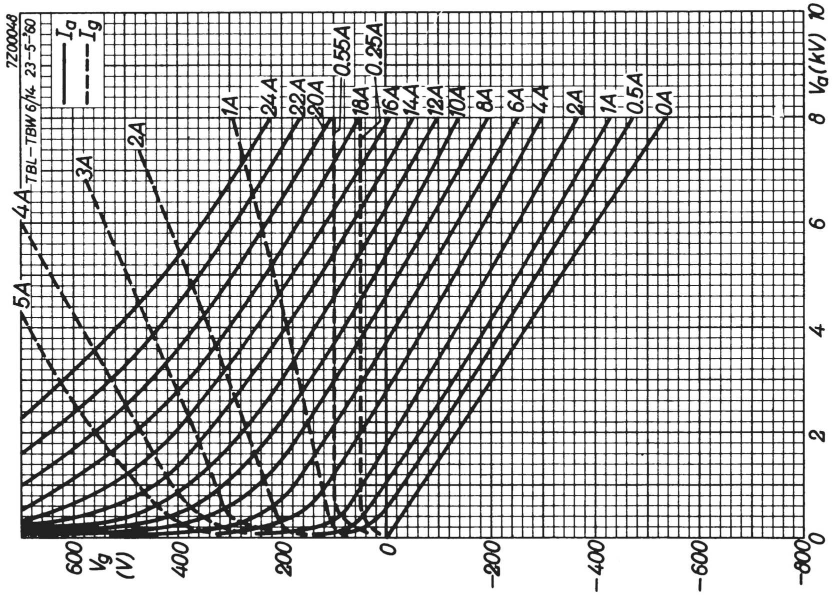
Frequency	f	30	30	MHz
Anode voltage	V_a	7	6	kV
Anode current, loaded	I_a	3.5	3.3	A
Anode current, unloaded	I_a	0.7	0.51	A
Grid current, loaded	I_g	0.95	0.8	A
Grid current, unloaded	I_g	1.35	1.1	A
Grid resistor	R_g	950	1000	Ω
Load resistance	$R_{a\sim}$	1000	870	Ω
Feedback ratio under loaded conditions	$V_{g\sim}/V_{a\sim}$	25	26	%
Anode input power	W_{ia}	24.5	19.8	kW
Anode dissipation	W_a	6.8	5.5	kW
Output power	W_o	17.7	14.3	kW
Efficiency	η	72	72	%
Output power in the load	W_ℓ	14	11	kW [1]

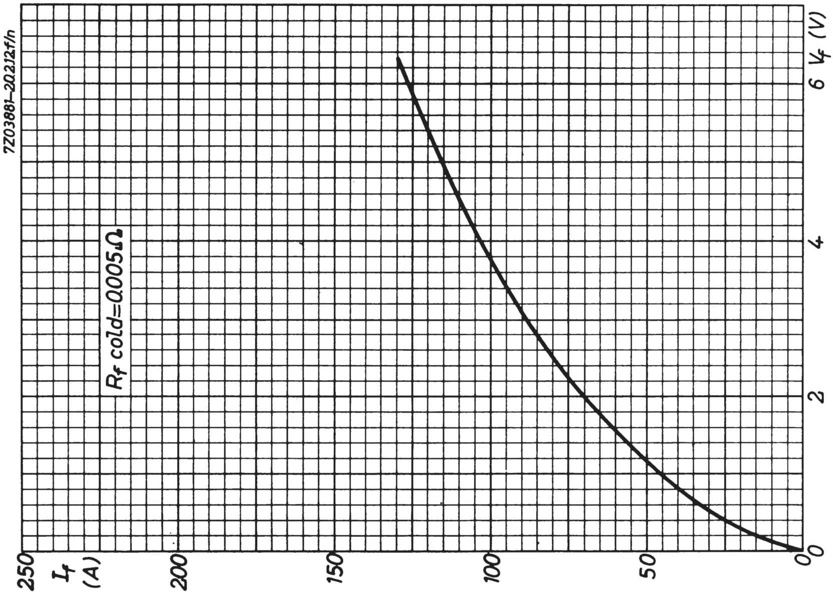
---

[1] Useful power in the load, measured in a circuit having an efficiency of about 85%.


7Z00046
TBL-TBW 6/14 23-5-'60
I_a (A)
0
10
20
30
V_g =
+700V
+600V
+500V
+400V
+300V
+200V
+100V
0V
−100V
−200V
−300V
−400V
0
2
4
6
8
V_a (kV)
10


7Z00047
TBL-TBW6/14 23-5-'60
I_g (A)
0
5
10
15
V_g=700V
600V
500V
400V
300V
200V
0
50V
100V
2
4
6
8
V_a (kV)
10


7Z00048
TBL-TBW 6/14 23-5-'60
I_a
I_g
5A
4A
3A
2A
1A
24A
22A
20A
0.55A
18A
0.25A
16A
14A
12A
10A
8A
6A
4A
2A
1A
0.5A
0A
V_a(kV)
0
2
4
6
8
10
V_g (V)
600
400
200
0
-200
-400
-600
-800


7Z03881-20.2.12f/h
R_f cold=0.005Ω
V_f (V)
0
2
4
6
I_f (A)
250
200
150
100
50
0

WATER COOLED R.F. POWER TRIODE WITH INTEGRAL HELICAL COOLER

QUICK REFERENCE DATA

General purposes

λ (m)	Freq. (MHz)	C telegr.		B teleph.		C_a mod.		B mod. 1)	
		V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)
4	75	6	6.9	6	1.9			6	13.3
		5	5.6	5	1.45	5	4.7	5	6.6
		4	4			4.5	4.1	4.5	6.0
						4	3.5	4	5.3
						3.5	3	3.5	4.6
						3	2.2	3	3.3

Television service

Freq. (MHz)	Neg. mod. Pos. sync.			Pos. mod. Neg. sync.	
	V_a (kV)	W_o sync (kW)	W_o black (kW)	V_a (kV)	W_o white (kW)
75	5	9	5.35	5	9

HEATING: direct, filament thoriated tungsten

Filament voltage	V_f	12.6	V
Filament current	I_f	33	A

CAPACITANCES

Anode to all other elements except grid	C_a	0.3	pF
Grid to all other elements except anode	C_g	16	pF
Anode to grid	C_{ag}	11	pF

---

1) Two tubes

TYPICAL CHARACTERISTICS

Anode voltage	V_a	4	kV
Anode current	I_a	1	A
Amplification factor	μ	32	
Mutual conductance	S	17	mA/V

COOLING : Water and low velocity air flow

TEMPERATURE LIMITS (Absolute limits)

Water inlet temperature	t_i	max.	50	°C
Temperature of filament seals		max.	210	°C
Temperature of anode and grid seals		max.	180	°C

WATER COOLING CHARACTERISTICS

W_a (kW)	t_i (°C)	q_{min} (l/min)	p_i (atm)	t_o (°C)
2	20	1.5	0.06	44
	50	3	0.22	62
4	20	3	0.22	42
	50	6	0.73	61
6	20	5	0.54	39
	50	10	1.8	59

At water inlet temperatures between 20 °C and 50 °C the required quantity of water can be found by linear interpolation.

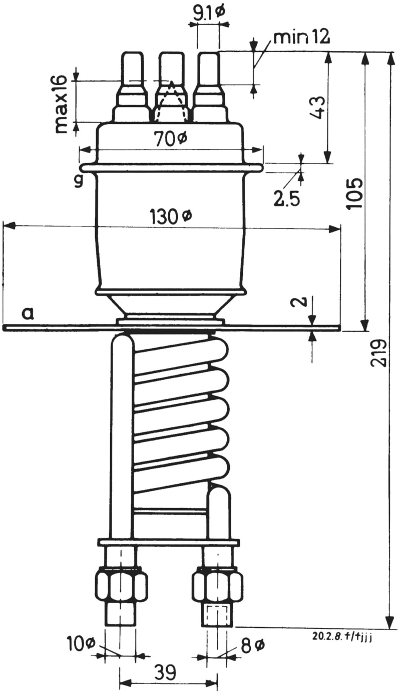
In general no air cooling will be required at ambient temperatures below 35 °C. At higher temperatures a low velocity air flow to the grid and filament seals will be necessary.

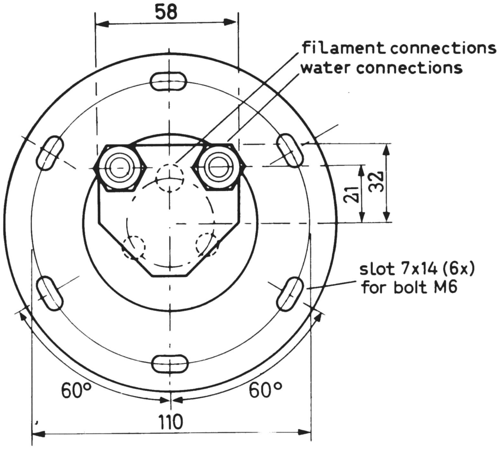
7Z2 8642

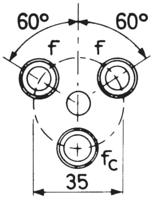
MECHANICAL DATA

Dimensions in mm

Filament connectors	40634
Grid connector	40622
Net weight	0.8 kg


9.1⌀
min 12
max16
43
70⌀
g
2.5
105
130⌀
a
2
219
10⌀
8⌀
39
20.2.8.f/fjjj


58
filament connections
water connections
21
32
slot 7x14 (6x)
for bolt M6
60°
60°
110


60°
60°
f
f
f_c
35

The use of wing nuts for connecting the water connections should be avoided

The centre tap f_c must not be used for filament current supply.
The connectors 40634, however, must be used for the cooling of all three filament pins, thus also of pin f_c.

Mounting position: vertical with anode down

For further data except cooling curves, please refer to type TBW6/6000

WATER COOLED INDUSTRIAL R.F. POWER TRIODE WITH INTEGRAL HELICAL COOLER

QUICK REFERENCE DATA		
Freq. (Mc/s)	Class C oscillator	
	V_a (kV)	W_o (kW)
50	6.0	6.0

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	12.6	V
Filament current	I_f	=	33	A

CAPACITANCES

Anode to all other elements except grid	C_a	=	0.3	pF
Grid to all other elements except anode	C_g	=	16	pF
Anode to grid	C_{ag}	=	11	pF

TYPICAL CHARACTERISTICS

Anode current	I_a	=	1	A
Anode voltage	V_a	=	6	kV
Amplification factor	μ	=	32	
Mutual conductance	S	=	15	mA/V

7Z2 8644

WATER COOLING CHARACTERISTICS

W_a (kW)	t_i (°C)	q_{min} (l/min)	p_i (atm)	t_o (°C)
2	20	1.5	0.06	44
	50	3	0.22	62
4	20	3	0.22	42
	50	6	0.73	61
6	20	5	0.54	39
	50	10	1.8	59

At water inlet temperatures between 20 °C and 50 °C the required quantity of water can be found by linear interpolation.

In general no air cooling will be required at frequencies up to 30 Mc/s and at ambient temperatures below 35 °C. At higher temperatures or at higher frequencies a low velocity air flow to the grid and filament seals will be necessary.

TEMPERATURE LIMITS (Absolute limits)

Water inlet temperature	t_i	= max.	50	°C
Temperature of filament seals		= max.	210	°C
Temperature of anode and grid seals		= max.	180	°C

ACCESSORIES

Filament connectors	40634
Connector for centre pin of the filament	40649
Grid connector	40650 or 40622

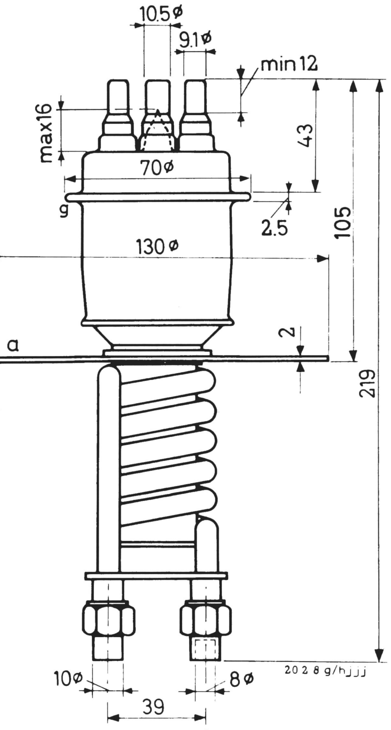
The centre filament pin f_c must not be used for filament current supply. However, the connector 40649 should be used for cooling of this pin.

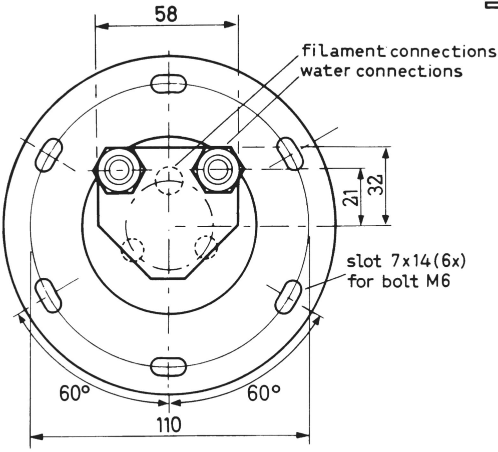
The grid connector 40650 must not be used at frequencies higher than 30 Mc/s.

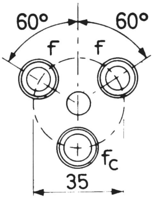
MECHANICAL DATA

Dimensions in mm

Net weight 0.8 kg


10.5ø
9.1ø
min 12
max16
43
70ø
g
2.5
105
130ø
2
a
219
10ø
8ø
39
20 2 8 g/hjjj


58
filament connections
water connections
21
32
slot 7x14(6x)
for bolt M6
60°
60°
110


60°
60°
f
f
f_c
35

The use of wing nuts for connecting the water connections should be avoided

Mounting position: Vertical with anode down

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from three-phase half-wave rectifier without filter

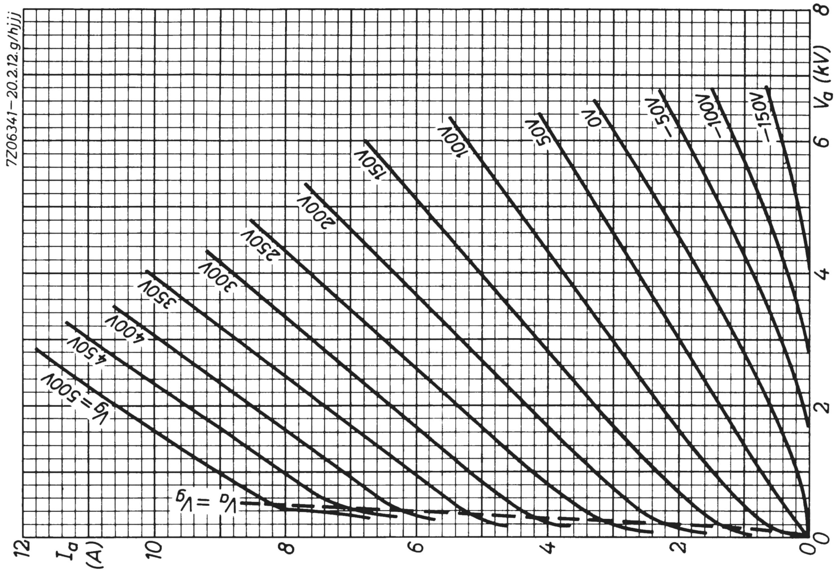
LIMITING VALUES (Absolute limits)

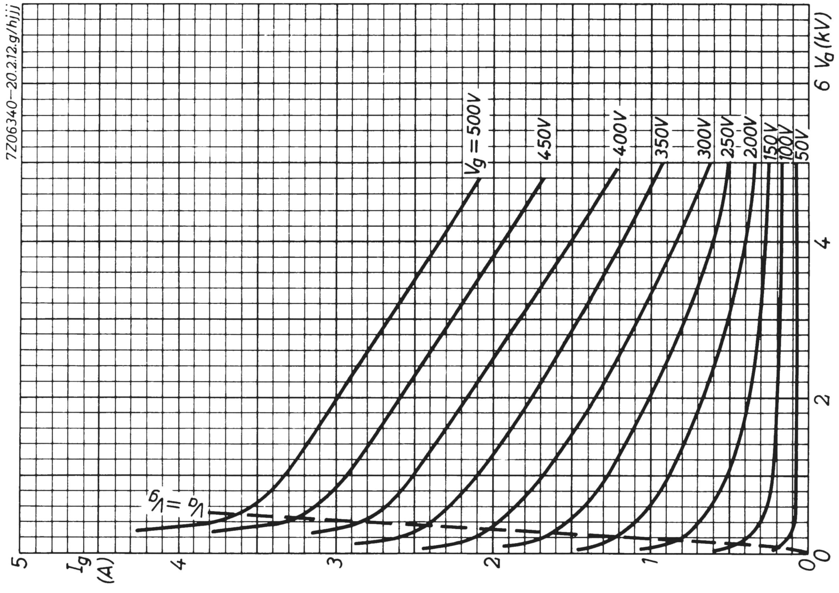
Frequency	f		up to	55	Mc/s
Anode voltage	V_a	=	max.	7	kV
Negative grid voltage	$-V_g$	=	max.	1250	V
Anode current	I_a	=	max.	1.8	A
Grid current, loaded	I_g	=	max.	0.5	A
Grid current, unloaded	I_g	=	max.	0.7	A
Anode input power	W_{ia}	=	max.	11	kW
Anode dissipation	W_a	=	max.	6	kW
Grid resistor	R_g	=	max.	10	kΩ

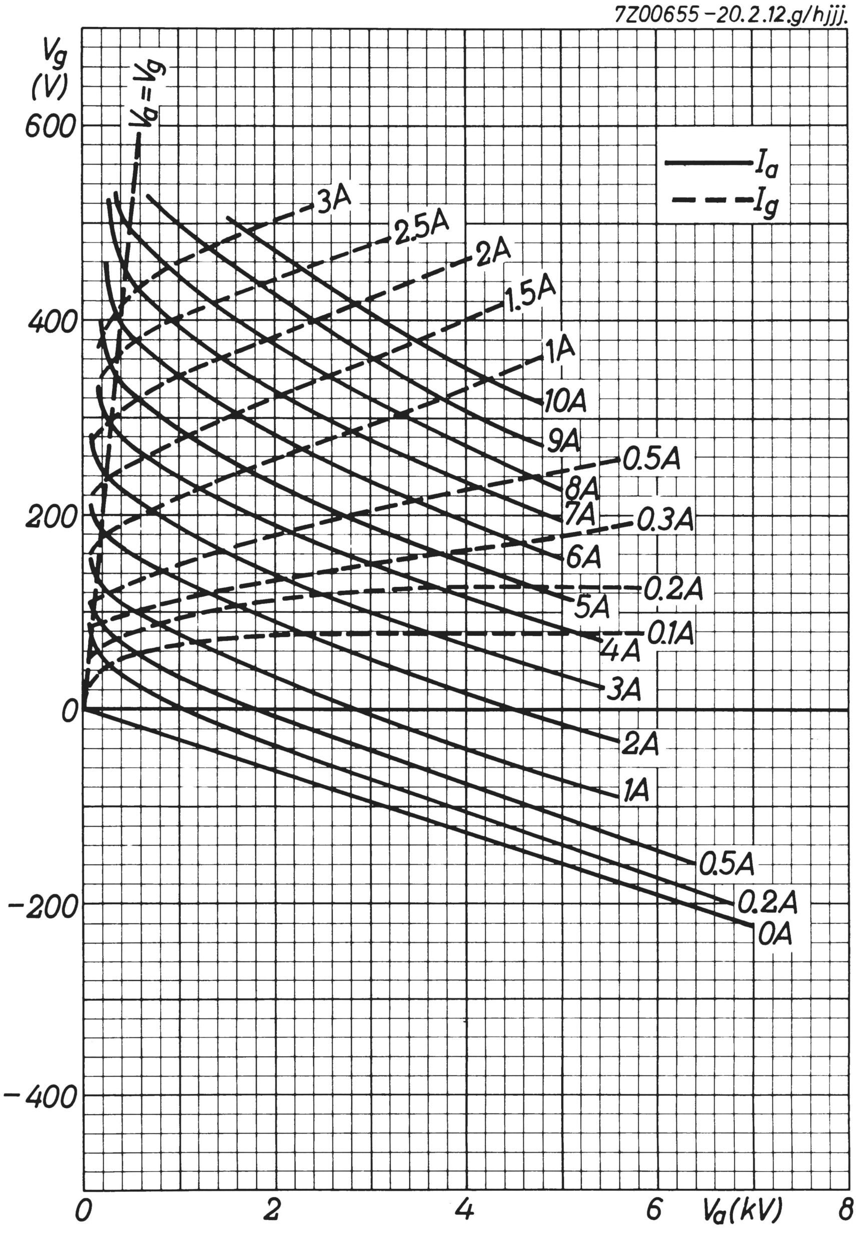
OPERATING CONDITIONS

Frequency	f	=	50	Mc/s
Transformer voltage	V_{tr}	=	5.1	kV_{RMS}
Anode voltage	V_a	=	6.0	kV
Anode current	I_a	=	1.5	A
Grid current	I_g	=	0.4	A
Grid input power	W_{ig}	=	300	W
Anode input power	W_{ia}	=	9	kW
Anode dissipation	W_a	=	2.7	kW
Output power	W_o	=	6	kW
Efficiency	η	=	67	%

7Z2 3530


7Z06341-20.2.12.g/hjjj
I_a (A)
12
10
8
6
4
2
0
V_a (kV)
0
2
4
6
8
V_g = 500V
450V
400V
350V
300V
250V
200V
150V
100V
50V
0V
−50V
−100V
−150V
$V_a = V_g$


7Z06340-20.2.12.g/hjjj
I_g (A)
5
4
3
2
1
0
V_a (kV)
0
2
4
6
V_g = 500V
450V
400V
350V
300V
250V
200V
150V
100V
50V
$V_a = V_g$


7Z00655-20.2.12.g/hjjj.
V_g (V)
600
400
200
0
-200
-400
$V_a = V_g$
I_a
I_g
3A
2.5A
2A
1.5A
1A
0.5A
0.3A
0.2A
0.1A
10A
9A
8A
7A
6A
5A
4A
3A
2A
1A
0.5A
0.2A
0A
0
2
4
6
8
V_a(kV)

WATER COOLED INDUSTRIAL R.F. POWER TRIODE WITH INTEGRAL HELICAL COOLER

QUICK REFERENCE DATA		
Industrial R.F. oscillator class C		
Freq.	Three phase	
(MHz)	V_a (kV)	W_ℓ [1] (kW)
50	7.2 6.2	6.1 5.0

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	12.6	V	+5 % -10 %
Filament current	I_f	=	33	A	

CAPACITANCES

Anode to all other elements except grid	C_a	=	1.0	pF
Grid to all other elements except anode	C_g	=	14.2	pF
Anode to grid	C_{ag}	=	7.9	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	6	kV
Anode current	I_a	=	1	A
Mutual conductance	S	=	12	mA/V
Amplification factor	μ	=	24	

---

[1]) Useful power in the load

7Z2 8646

TEMPERATURE LIMITS (Absolute limits)

Water inlet temperature t_i = max. 50 °C

Temperature of the seals = max. 220 °C

WATER COOLING CHARACTERISTICS

W_a (kW)	t_i (°C)	q_{min} (l/min)	p_i (atm)	t_o (°C)
2	20	1	0.032	56
	50	2	0.084	68
4	20	2.2	0.10	49
	50	4.4	0.49	65
6	20	4	0.41	43
	50	8	1.4	62

At water inlet temperatures between 20 and 50 °C the required quantity of water can be found by linear interpolation.

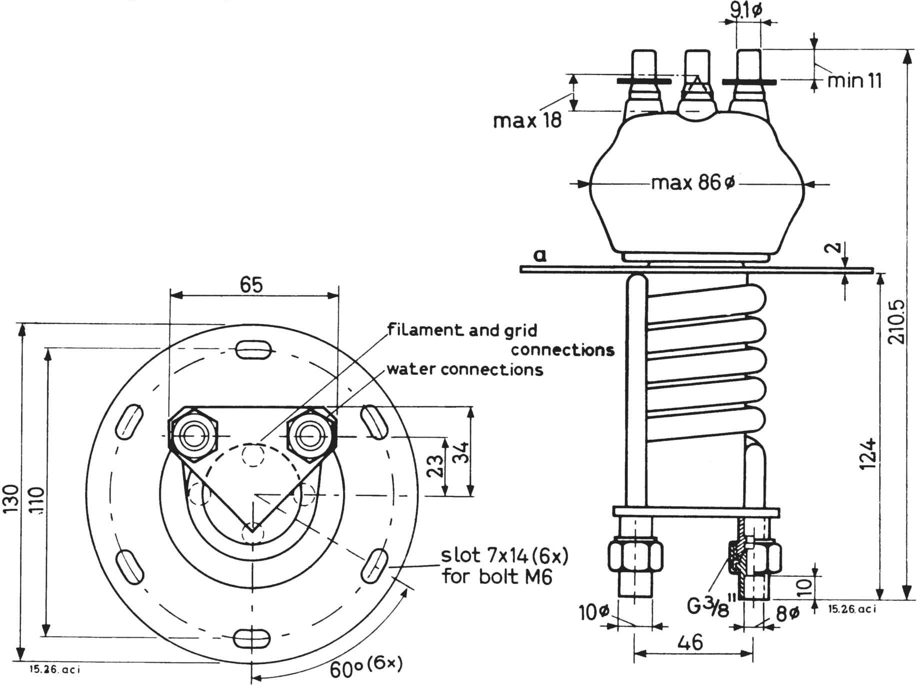
At frequencies above 4 MHz a low velocity air flow should be directed to the seals.

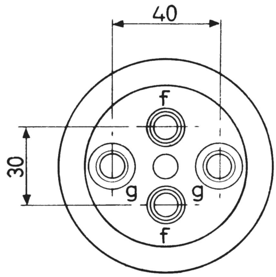
At frequencies above 4 MHz both grid terminals should be connected in parallel and care should be taken to distribute the R.F. current equally over both grid terminals to avoid excessive temperatures.

MECHANICAL DATA

Dimensions in mm

Net weight 1 kg


9.1⌀
min 11
max 18
max 86⌀
a
2
210.5
124
65
filament and grid connections
water connections
130
110
23
34
slot 7x14 (6x) for bolt M6
60° (6x)
10⌀
G3/8"
8⌀
10
46
15.26.aci
15.26.aci



The use of wing nuts for connecting the water connections should be avoided

Mounting position: vertical with anode down

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from three-phase rectifier without filter

LIMITING VALUES (Absolute limits), continuous service

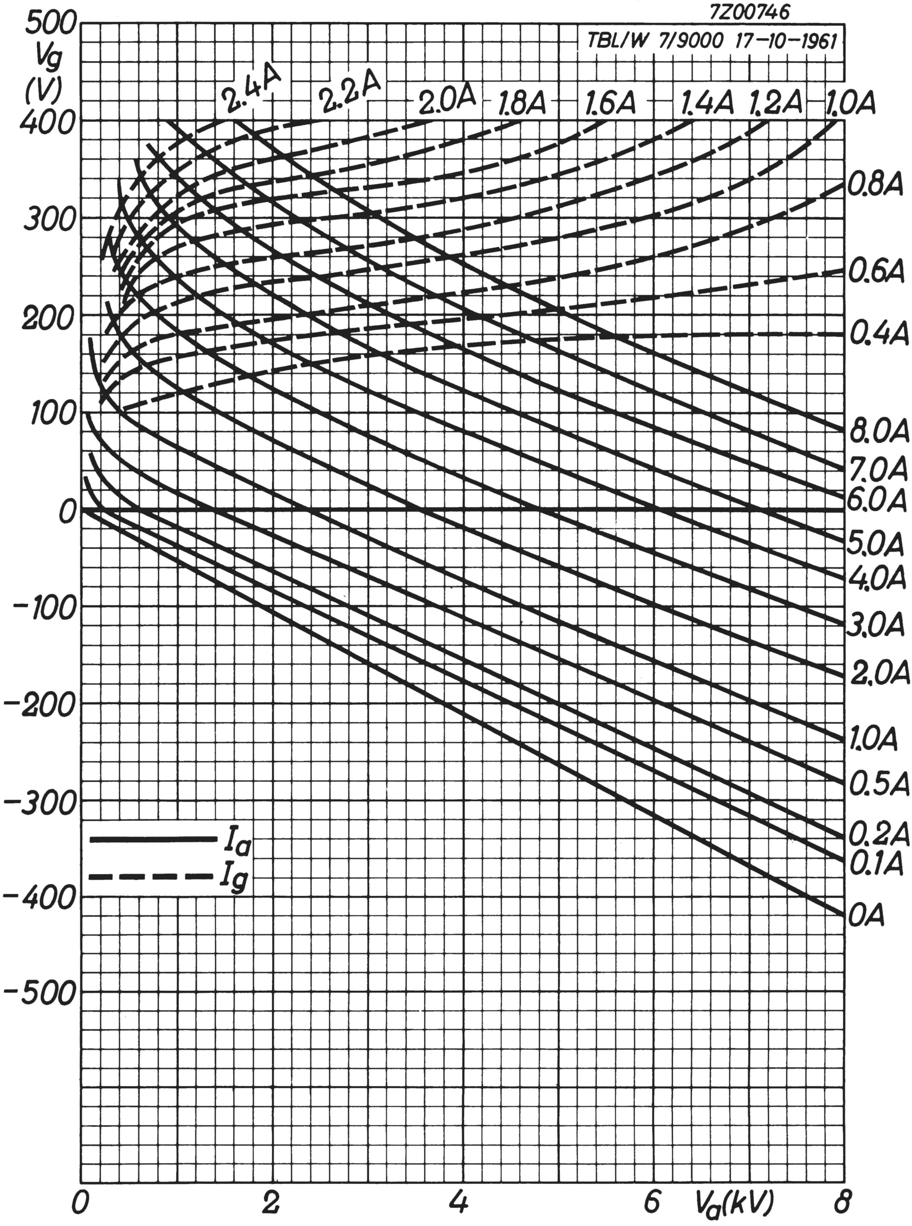
Frequency	f		up to	50	MHz
Anode voltage	V_a	=	max.	8	kV
Anode input power	W_{ia}	=	max.	12	kW
Anode dissipation	W_a	=	max.	6	kW
Anode current	I_a	=	max.	1.8	A
Negative grid voltage	$-V_g$	=	max.	1250	V
Grid current, loaded	I_g	=	max.	0.4	A
Grid current, unloaded	I_g	=	max.	0.5	A
Grid circuit resistance	R_g	=	max.	10	kΩ

OPERATING CHARACTERISTICS , continuous service

Frequency	f	=	50	50	MHz
Anode voltage	V_a	=	7200	6200	V
Anode current, loaded	I_a	=	1.5	1.4	A
Anode current, unloaded	I_a	=	0.37	0.40	A
Grid current, loaded	I_g	=	0.36	0.37	A
Grid current, unloaded	I_g	=	0.47	0.47	A
Grid resistor	R_g	=	1850	1500	Ω
Load resistance	$R_{a\sim}$	=	2300	2100	Ω
Feedback ratio under loaded conditions	$V_{g\sim}/V_{a\sim}$	=	17	17	%
Anode input power	W_{ia}	=	10.8	8.68	kW
Anode dissipation	W_a	=	3.3	2.5	kW
Efficiency	η	=	70	71	%
Output power in the load	W_ℓ	=	6.1	5.0	kW 1)

---

1) Useful power in the load, measured in a circuit having an efficiency of 85 %


7Z00746
TBL/W 7/9000 17-10-1961
500
Vg
(V)
400
300
200
100
0
-100
-200
-300
-400
-500
0
2
4
6
Va(kV)
8
2.4A
2.2A
2.0A
1.8A
1.6A
1.4A
1.2A
1.0A
0.8A
0.6A
0.4A
8.0A
7.0A
6.0A
5.0A
4.0A
3.0A
2.0A
1.0A
0.5A
0.2A
0.1A
0A
Ia
Ig

WATER COOLED INDUSTRIAL R.F. POWER TRIODE WITH INTEGRAL HELICAL COOLER

QUICK REFERENCE DATA		
Industrial R.F. oscillator class C		
Freq. (MHz)	Three phase	
	V_a (kV)	W_o (kW)
30	12	29.0
	10	23.3
	8	17.9

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	8.0	V $^{+\ 5\%}_{-10\%}$
Filament current	I_f	=	98	A
Cold filament resistance	R_f	=	0.008	Ω

The filament current must never exceed a peak value of 210 A instantaneously at any time during the initial energizing schedule

CAPACITANCES

Anode to all other elements except grid	C_a	=	0.4	pF
Grid to all other elements except anode	C_g	=	37	pF
Anode to grid	C_{ag}	=	30	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	12	kV
Anode current	I_a	=	2	A
Amplification factor	μ	=	34	
Mutual conductance	S	=	20	mA/V

7Z2 8647

TEMPERATURE LIMITS (Absolute limits)

Water inlet temperature t_i = max. 50 °C

Temperature off all seals = max. 220 °C

WATER COOLING CHARACTERISTICS

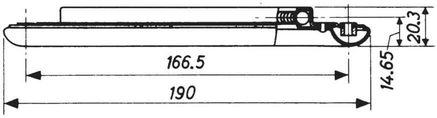
W_a (kW)	t_i (°C)	q_{min} (l/min)	p_i (atm.)
10	20	4.2	0.08
	50	8.4	0.27
15	20	6.5	0.16
	50	13.0	0.50
20	20	9.3	0.30
	50	18.6	1.0

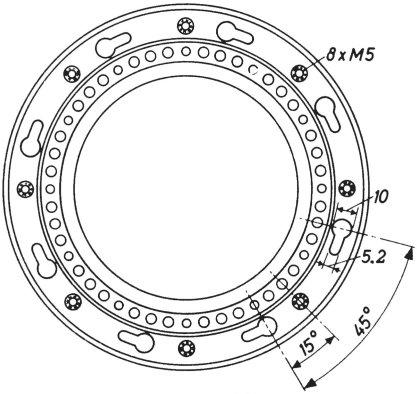
At water inlet temperatures between 20 °C and 50 °C the required quantity of water can be found by linear interpolation

Generally a low velocity air flow to the seals is required

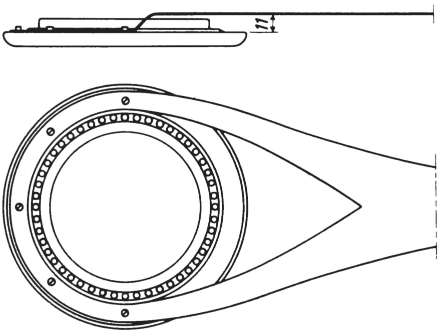
MECHANICAL DATA

Dimensions in mm





Grid connector 40663



Connection of the grid lead

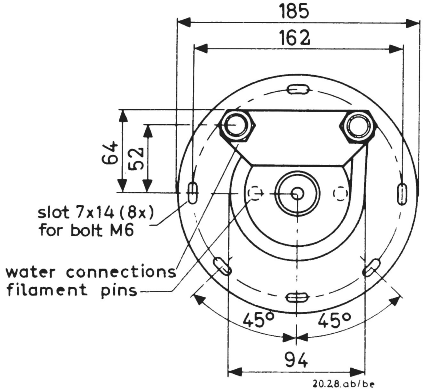
The rounded side of the grid connector should face the anode. To ensure a uniform R.F. current distribution in the grid seal at frequencies higher than 4 MHz, the grid lead should be connected as shown at right.

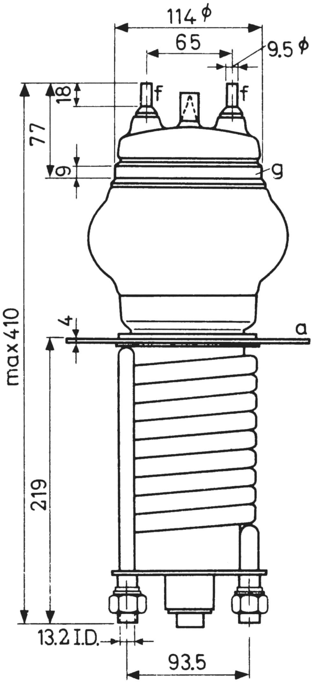
7Z2 3556

MECHANICAL DATA (continued)

Dimensions in mm

Filament connectors with cable	40662
Grid connector	40663
Net weight	5.2 kg


185
162
64
52
slot 7x14 (8x)
for bolt M6
water connections
filament pins
45°
45°
94
20.2.8.ab/be


114 ϕ
65
9.5 ϕ
18
f
f
77
9
g
max 410
4
a
219
13.2 I.D.
93.5

Mounting position: vertical with anode down

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from three-phase half-wave rectifier without filter

LIMITING VALUES (Absolute limits)

Frequency	f		up to	30	MHz
Anode voltage	V_a	=	max.	13	kV
Anode current	I_a	=	max.	4.8	A
Anode dissipation	W_a	=	max.	20	kW
Anode input power	W_{ia}	=	max.	60	kW
Negative grid voltage	$-V_g$	=	max.	1500	V
Grid current	I_g	=	max.	0.8	A
Grid circuit resistance	R_g	=	max.	10	kΩ

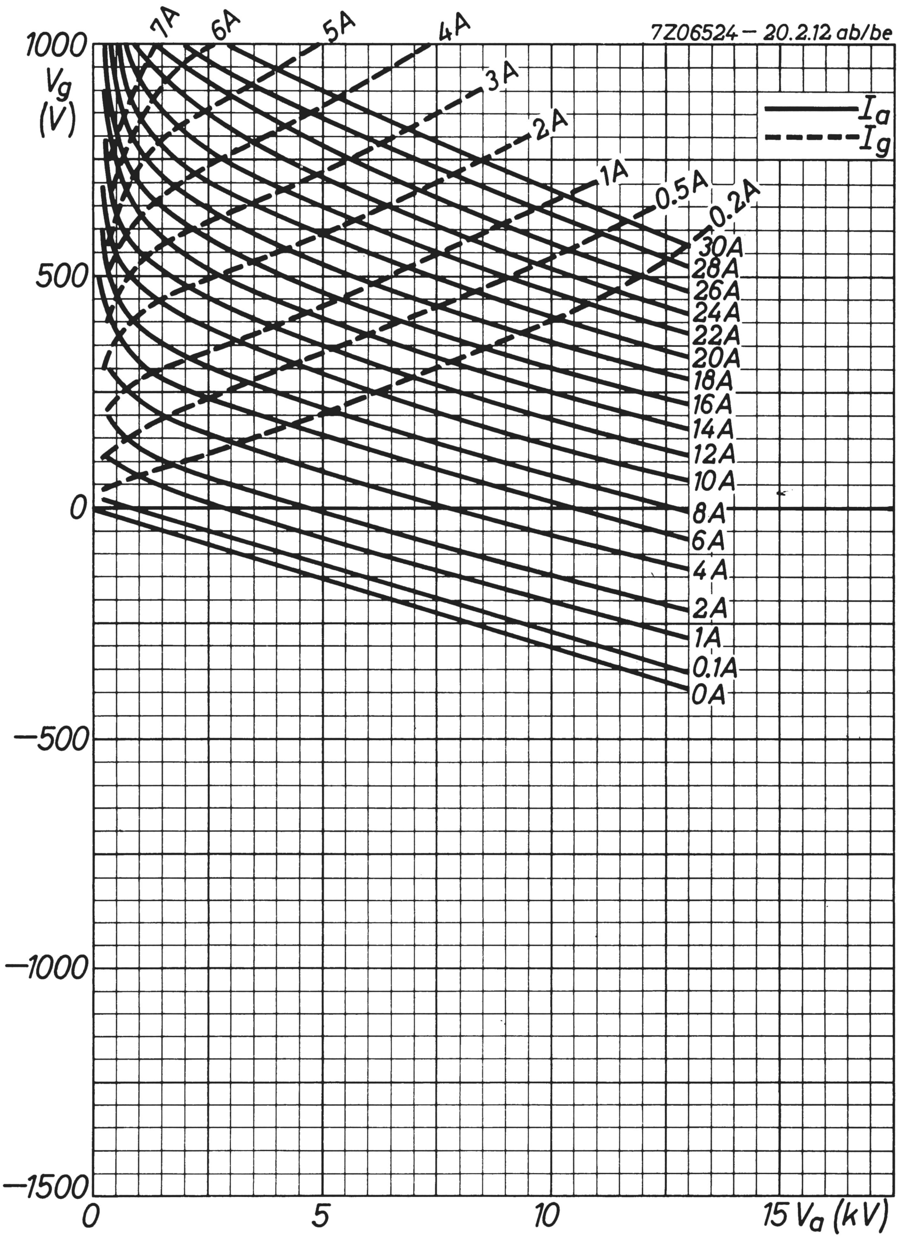
OPERATING CONDITIONS

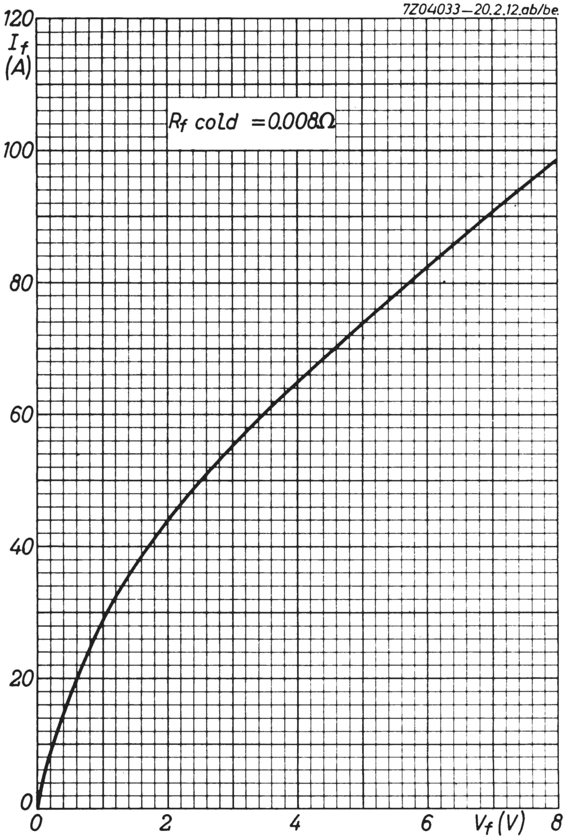
Frequency	f	=	30	30	30	MHz
Transformer voltage	V_{tr}	=	8.9	7.4	6.0	kV
Anode voltage	V_a	=	12	10	8	kV
Anode current, loaded	I_a	=	3.2	3.2	3.2	A
Anode current, unloaded	I_a	=	0.52	0.50	0.48	A
Grid current, loaded	I_g	=	0.50	0.50	0.50	A
Grid current, unloaded	I_g	=	0.74	0.77	0.80	A
Grid resistor	R_g	=	2.0	1.6	1.1	kΩ
Load resistance	$R_{a\sim}$	=	1800	1450	1100	Ω
Feedback ratio under loaded conditions	$V_{g\sim}/V_{a\sim}$	=	16	17	19	%
Anode input power	W_{ia}	=	38.4	32.0	25.6	kW
Anode dissipation	W_a	=	9.4	8.7	7.7	kW
Output power	W_o	=	29.0	23.3	17.9	kW
Efficiency	η	=	75.5	72.5	70	%
Output power in the load	W_ℓ	=	25	20	15.5	kW[1]

---

[1] Useful power in the load measured in a circuit having an efficiency of 90%

7Z2 3554


7Z06524 — 20.2.12 ab/be
1000
Vg
(V)
500
0
−500
−1000
−1500
0
5
10
15 Va (kV)
Ia
Ig
7A
6A
5A
4A
3A
2A
1A
0.5A
0.2A
30A
28A
26A
24A
22A
20A
18A
16A
14A
12A
10A
8A
6A
4A
2A
1A
0.1A
0A


7Z04033—20.2.12.ab/be.
I_f (A)
120
100
80
60
40
20
0
R_f cold = 0.008Ω
0
2
4
6
V_f (V)
8

WATER COOLED INDUSTRIAL R.F. POWER TRIODE WITH INTEGRAL HELICAL COOLER

QUICK REFERENCE DATA

Freq. (MHz)	C osc. industrial	
	V_a (kV)	W_o (kW)
30	12 10 8	39 31.3 23.2

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	8	V	+ 5 % −10 %
Filament current	I_f	=	130	A	
Cold filament resistance	R_f	=	0.006	Ω	

The filament current must never exceed a peak value of 280 A at any time during the initial energizing schedule

CAPACITANCES

Anode to all other elements except grid	C_a	=	0.9	pF
Grid to all other elements except anode	C_g	=	45	pF
Anode to grid	C_{ag}	=	23.5	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	12	kV
Anode current	I_a	=	2	A
Amplification factor	μ	=	21	
Mutual conductance	S	=	25	mA/V

TEMPERATURE LIMITS (Absolute limits)

Temperature of all seals = max. 220 °C

Water inlet temperature t_i = max. 50 °C

7Z2 8649

COOLING: Generally a low velocity air flow to the seals is required

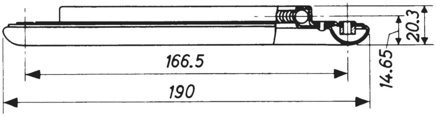
WATER COOLING CHARACTERISTICS

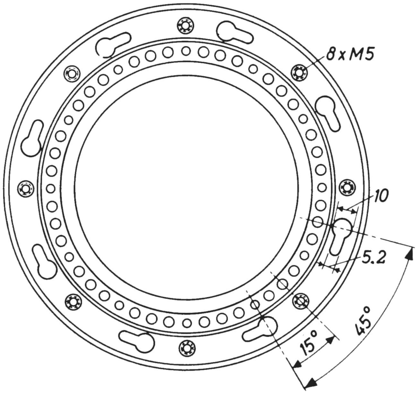
W_a (kW)	t_i (°C)	q_{min} (l/min)	p_i (atm.)
10	20	4.2	0.08
	50	8.4	0.27
15	20	6.5	0.16
	50	13.0	0.5
20	20	9.3	0.3
	50	18.6	1.0

At water inlet temperatures between 20 °C and 50 °C the required quantity of water can be found by linear interpolation

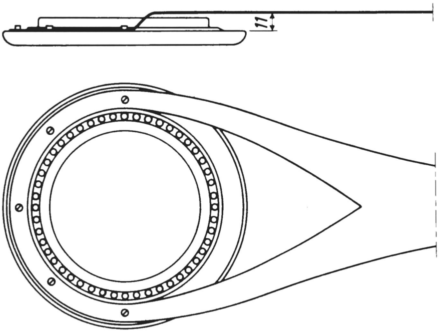
MECHANICAL DATA

Dimensions in mm





Grid connector 40663



Connection of the grid lead

The rounded side of the grid connector should face the anode. To ensure a uniform RF current distribution in the grid seal at frequencies higher than 4 MHz, the grid lead should be connected as shown in the figure at right.

7Z2 3567

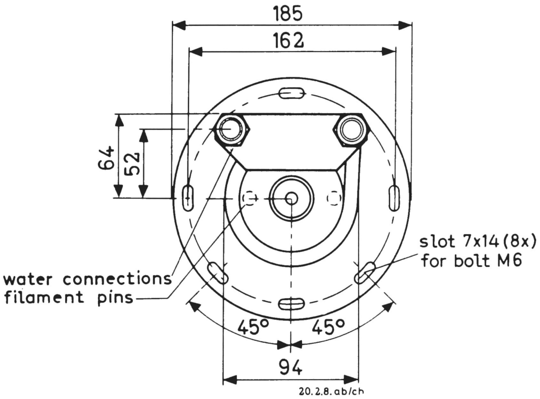
MECHANICAL DATA (continued)

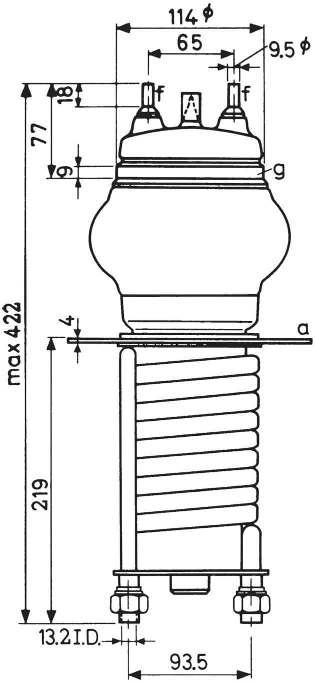
Dimensions in mm

Connectors with cable for filament : 40662

Grid connector 40663

Net weight : 5.4 kg


185
162
64
52
slot 7x14 (8x)
for bolt M6
water connections
filament pins
45°
45°
94
20.2.8.ab/ch


114 ϕ
65
9.5 ϕ
18
f
f
77
9
g
max 422
4
a
219
13.2 I.D.
93.5

Mounting position: vertical with anode down

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from three-phase rectifier without filter

LIMITING VALUES (Absolute limits)

Frequency	f	up to	30	MHz
Anode voltage	V_a	= max.	13	kV
Anode current	I_a	= max.	5	A
Anode dissipation	W_a	= max.	20	kW
Anode input power	W_{ia}	= max.	60	kW
Negative grid voltage	$-V_g$	= max.	2	kV
Grid current, loaded	I_g	= max.	1.5	A
Grid current, unloaded	I_g	= max.	2.0	A
Grid circuit resistance	R_g	= max.	10	kΩ

OPERATING CONDITIONS

Frequency	f	=	30	30	30	MHz
Anode voltage	V_a	=	12	10	8	kV
Anode current, loaded	I_a	=	4.5	4.5	4.5	A
Anode current, unloaded	I_a	=	0.65	0.63	0.62	A
Grid current, loaded	I_g	=	0.9	0.9	0.9	A
Grid current, unloaded	I_g	=	1.22	1.3	1.35	A
Grid resistor	R_g	=	1100	1000	900	Ω
Load resistance	$R_{a\sim}$	=	1450	1100	800	Ω
Feedback ratio under loaded conditions	$V_{g\sim}/V_{a\sim}$	=	16	19	24	%
Anode input power	W_{ia}	=	54	45	36	kW
Anode dissipation	W_a	=	15	13.7	12.8	kW
Output power	W_o	=	39	31.3	23.2	kW
Efficiency	η	=	72.5	70	64.5	%
Output power in the load	W_ℓ	=	30	25	18	kW[1]

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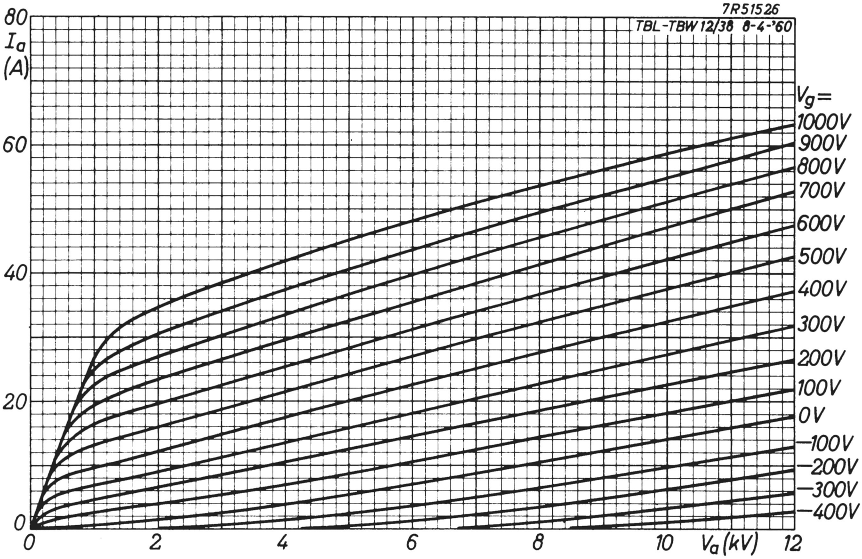
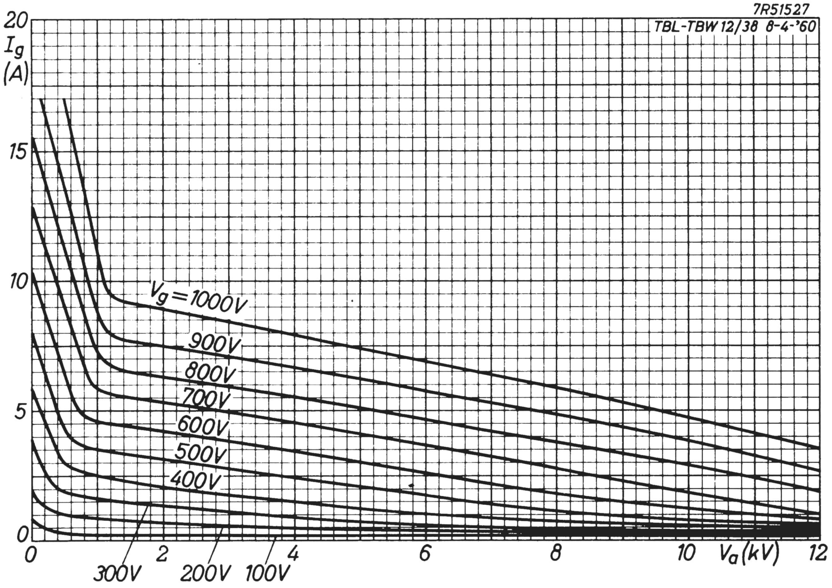
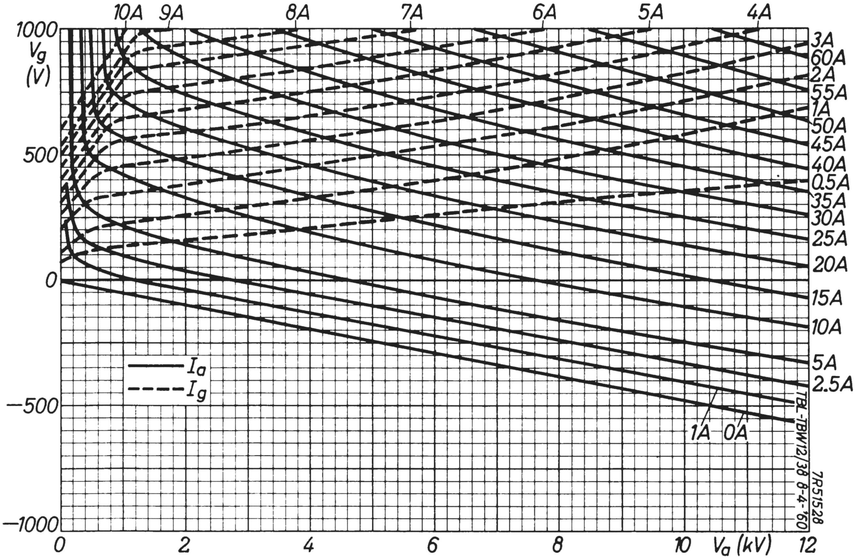
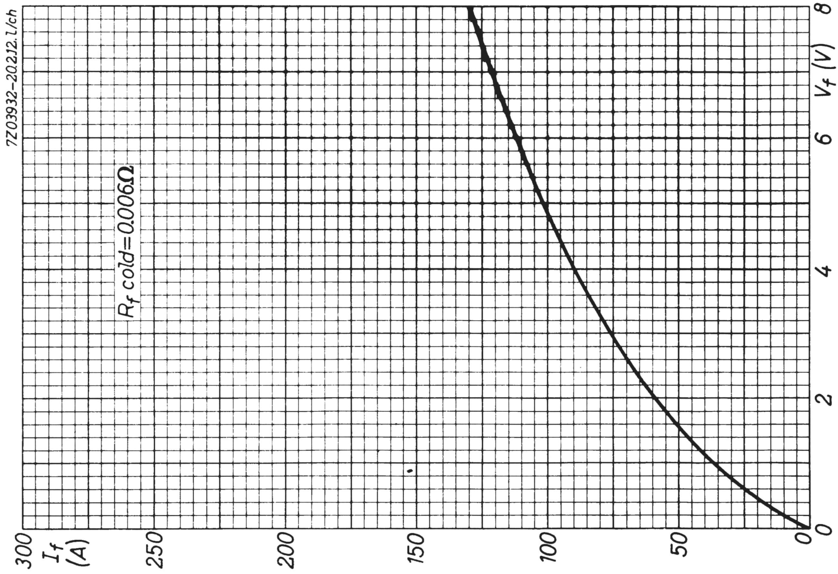
[1] Useful power in the load, measured in a circuit having an efficiency of about 85%.

7Z2 3565


7R51526
TBL-TBW 12/38 8-4-'60
80
60
40
20
0
I_a (A)
V_g=
1000V
900V
800V
700V
600V
500V
400V
300V
200V
100V
0V
−100V
−200V
−300V
−400V
0
2
4
6
8
10
12
V_a (kV)


7R51527
TBL-TBW 12/38 8-4-'60
20
15
10
5
0
I_g (A)
V_g=1000V
900V
800V
700V
600V
500V
400V
300V
200V
100V
0
2
4
6
8
10
12
V_a (kV)


10A
9A
8A
7A
6A
5A
4A
1000
V_g (V)
500
0
−500
−1000
3A
60A
2A
55A
1A
50A
45A
40A
0.5A
35A
30A
25A
20A
15A
10A
5A
2.5A
1A
0A
I_a
I_g
0
2
4
6
8
10
V_a (kV)
12
TBL-TBW12/38 8-4-'60
7R51528


7Z03932-20.212.1/ch
R_f cold=0.006Ω
300
I_f (A)
250
200
150
100
50
0
0
2
4
6
8
V_f (V)

AIR COOLED COAXIAL R.F. POWER TRIODE

QUICK REFERENCE DATA				
Frequency (MHz)	C telegr.		C an.mod.	
	V_a (V)	W_o (W)	V_a (V)	W_o (W)
175	2500	475	2000	505
300	2000	460	1600	370
470	1750	405	1400	275
600	1600	350	1280	225
900	1300	155	1040	107

Industrial oscillator class C				
Frequency (MHz)	AC operation		Single-phase full-wave with filter	
	V_{tr} (V)	W_o (W)	V_a (V)	W_o (W)
470	1750	235	1750	385

HEATING: direct; filament thoriated tungsten

Frequency	f	< 600	600 to 750	750 to 900	MHz
Filament voltage	V_f	= 3.4	3.3	3.2	V
Filament current	I_f	= 19	–	–	A

CAPACITANCES

Anode to all except grid	C_a	< 0.12	pF
Grid to all except anode	C_g	= 9	pF
Anode to grid	C_{ag}	= 4	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	= 2000	V
Anode current	I_a	= 150	mA
Amplification factor	μ	= 32	
Mutual conductance	S	= 10	mA/V

AIR COOLING CHARACTERISTICS

W_a (W)	h (m)	t_i (°C)	q_{min} (m^3/min)	p_i (mm H_2O)
< 300	0	45	0.45	24.0
	1500	35	0.46	22.5
	3000	25	0.49	21.5

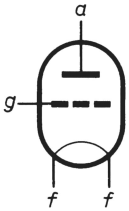
Temperature of envelope = max. 200 °C

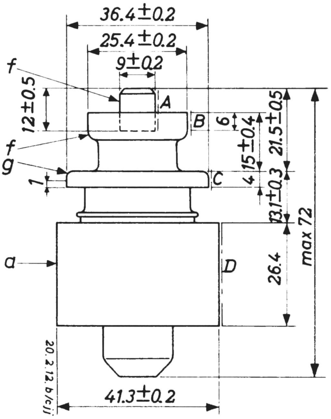
Generally it will be necessary to direct an air flow to the centre filament seal.

MECHANICAL DATA

Dimensions in mm

Net weight: 143 g




36.4±0.2
25.4±0.2
9±0.2
f
12±0.5
A
B
6
f
g
1
C
4.15±0.4
21.5±0.5
13.1±0.3
26.4
max 72
a
D
41.3±0.2
20.2.12.b/c/i

Eccentricity of the electrode connections: The electrode connections A, B and C are within cylindrical surfaces having a diameter of 9.5, 25.9 and 36.9 mm respectively and being coaxial with the cylindrical surface D.

Mounting position: vertical with anode up or down

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

Frequency	f		up to 175	300	470	600	900	MHz
Anode voltage	V_a	= max.	2500	2000	1750	1600	1300	V
Anode current	I_a	= max.	400	400	400	400	400	mA
Anode input power	W_{i_a}	= max.	1000	800	700	640	520	W
Anode dissipation	W_a	= max.	300	300	300	300	300	W
Negative grid voltage	$-V_g$	= max.	300	300	300	300	300	V
Grid current	I_g	= max.	120	120	120	120	120	mA

OPERATING CONDITIONS

Data for grounded grid circuit except for the data at 175 MHz which refer to a grounded cathode circuit.

Frequency	f	=	175	300	470	600	900	MHz
Anode voltage	V_a	=	2500	2000	1750	1600	1300	V
Anode current	I_a	=	260	335	380	400	350	mA
Grid voltage	V_g	=	-200	-120	-105	-90	-60	V
Grid current	I_g	=	100	100	100	100	100	mA
Peak grid AC voltage	V_{gp}	=	275	-	-	-	-	V
Grid input power	W_{i_g}	=	25	-	-	-	-	W
Anode input power	W_{i_a}	=	650	670	665	640	455	W
Anode dissipation	W_a	=	175	210	260	290	300	W
Output power	W_o	=	475	460	405	350	155	W
Efficiency	η	=	73	69	61	55	34	%

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

Frequency	f		up to 175	300	470	600	900	MHz
Anode voltage	V_a	= max.	2000	1600	1400	1280	1040	V
Anode current	I_a	= max.	335	335	335	335	335	mA
Anode input power	W_{ia}	= max.	670	536	465	429	348	W
Anode dissipation	W_a	= max.	200	200	200	200	200	W
Negative grid voltage	$-V_g$	= max.	300	300	300	300	300	V
Grid current	I_g	= max.	120	120	120	120	120	mA

OPERATING CONDITIONS

Data for grounded grid circuit except for the data at 175 MHz which refer to a grounded cathode circuit

Frequency	f	=	175	300	470	600	900	MHz
Anode voltage	V_a	=	2000	1600	1400	1280	1040	V 1)
Anode current	I_a	=	335	335	332	332	290	mA
Grid voltage	V_g	=	-200 2)	-140 2)	-120	-100	-80	V
Grid current	I_g	=	120	120	110	100	80	mA
Peak grid AC voltage	V_{gp}	=	275	-	-	-	-	V
Grid input power	W_{ig}	=	30	-	-	-	-	W
Anode input power	W_{ia}	=	670	536	465	425	302	W
Anode dissipation	W_a	=	165	166	190	200	200	W
Output power	W_o	=	505	370	275	225	102	W
Efficiency	η	=	75.5	69	59	53	34	%
Modulation depth	m	=	100	100	100	100	100	%
Modulation power	W_{mod}	=	335	268	233	213	151	W

---

1) With respect to cathode

2) Partially fixed bias

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with self-rectification

LIMITING VALUES (Absolute limits)

Frequency	f	up to	470	MHz
Transformer voltage	V_{tr}	= max.	1800	V(RMS)
Anode current	I_a	= max.	210	mA
Anode input power	W_{ia}	= max.	400	W
Anode dissipation	W_a	= max.	170	W
Negative grid voltage	$-V_g$	= max.	500	V
Grid current, loaded	I_g	= max.	85	mA
Grid current, unloaded	I_g	= max.	120	mA
Grid circuit resistance	R_g	= max.	5	kΩ

OPERATING CONDITIONS

Frequency	f	=	470	MHz
Transformer voltage	V_{tr}	=	1750	V(RMS)
Anode current, loaded	I_a	=	185	mA
Anode current, unloaded	I_a	=	105	mA
Grid current, loaded	I_g	=	75	mA
Grid current, unloaded [1]	I_g	=	80	mA
Grid circuit resistance under matched conditions	R_g	=	400	Ω
Anode input power	W_{ia}	=	365	W
Anode dissipation	W_a	=	130	W
Tube output power	W_o	=	235	W
Tube efficiency	η	=	64	%
Output power in the load [2]	W_ℓ	=	165	W

---

[1] The grid resistance is obtained by a current stabilising device

[2] Measured by a calorimetric method

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from a single-phase full-wave rectifier with filter.

LIMITING VALUES (Absolute limits)

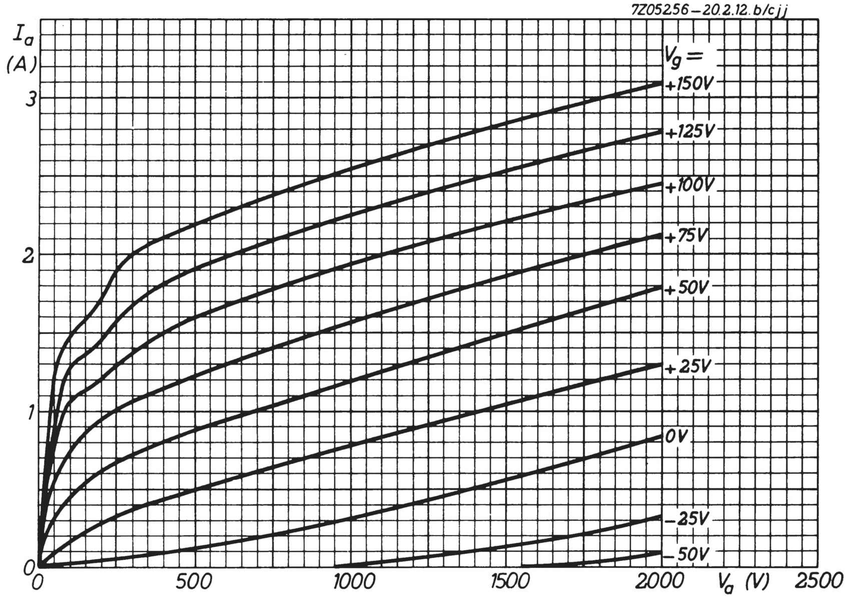
Frequency	f	up to	470	MHz
Anode voltage	V_a	= max.	1800	V
Anode current	I_a	= max.	400	mA
Anode input power	W_{i_a}	= max.	700	W
Anode dissipation	W_a	= max.	300	W
Negative grid voltage	$-V_g$	= max.	300	V
Grid current, loaded	I_g	= max.	110	mA
Grid current, unloaded	I_g	= max.	120	mA
Grid circuit resistance	R_g	= max.	5	kΩ

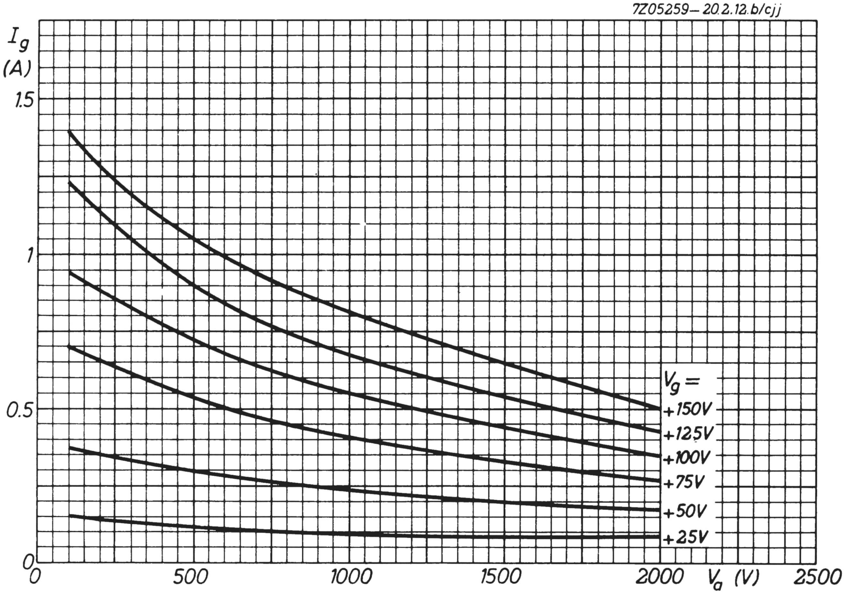
OPERATING CONDITIONS

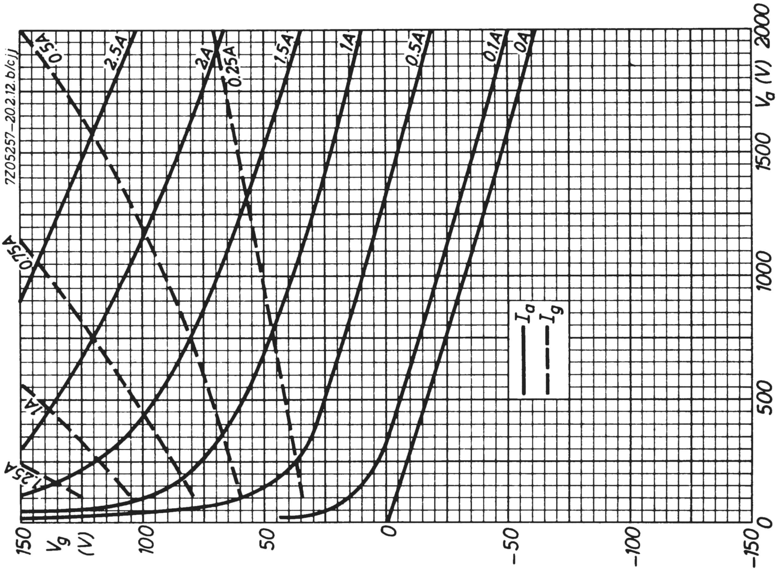
Frequency	f	=	470	MHz
Anode voltage	V_a	=	1750	V
Anode current, loaded	I_a	=	340	mA
Anode current, unloaded	I_a	=	170	mA
Grid current, loaded	I_g	=	95	mA
Grid current, unloaded 1)	I_g	=	100	mA
Grid circuit resistance under matched conditions	R_g	=	1000	Ω
Anode input power	W_{i_a}	=	595	W
Anode dissipation	W_a	=	210	W
Tube output power	W_o	=	385	W
Tube efficiency	η	=	65	%
Output power in the load	W_ℓ	=	270	W

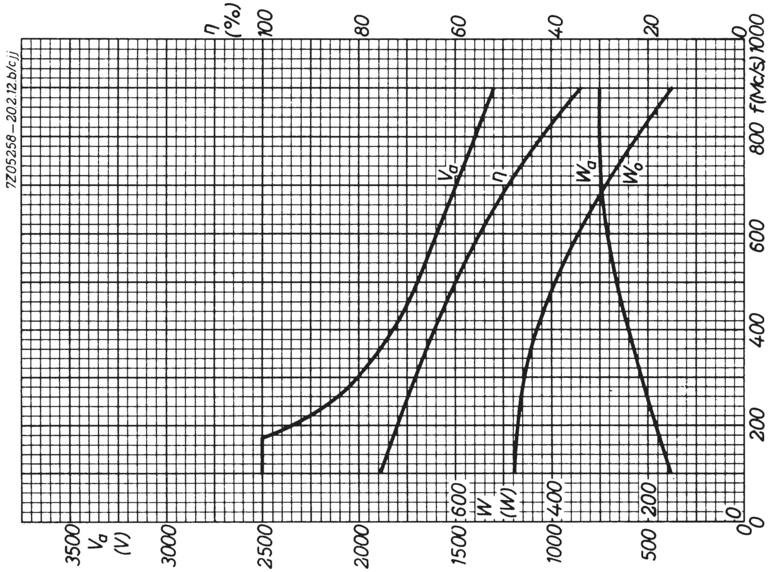
---

1) The grid resistance is obtained by a current stabilising device.


7Z05256–20.2.12.b/cjj
I_a
(A)
3
2
1
0
0
500
1000
1500
2000
V_a (V)
2500
V_g =
+150V
+125V
+100V
+75V
+50V
+25V
0V
−25V
−50V


7Z05259–20.2.12.b/cjj
I_g
(A)
1.5
1
0.5
0
0
500
1000
1500
2000
V_a (V)
2500
V_g =
+150V
+125V
+100V
+75V
+50V
+25V


7Z05257-20.2.12.b/cjj
V_a (V)
0
500
1000
1500
2000
V_g (V)
150
100
50
0
−50
−100
−150
2.5A
2A
1.5A
1A
0.5A
0.1A
0A
0.5A
0.75A
1A
1.25A
0.25A
I_a
I_g


7Z05258-20.2.12.b/cjj
η (%)
100
80
60
40
20
0
f (Mc/s)
0
200
400
600
800
1000
V_a (V)
3500
3000
2500
2000
1500
1000
500
0
W (W)
600
400
200
0
V_a
η
W_a
W_o

AIR COOLED COAXIAL R.F. POWER TRIODE

QUICK REFERENCE DATA						
Frequency (MHz)	C telegr. grounded grid		Industrial oscillator class C			
			DC operation		AC operation	
	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_{tr} (V)	W_o (W)
470	2000	595	2000	480	1800	230
640	1800	490				
730	1800	460				
810	1800	408	1800	284		

HEATING: direct; filament thoriated tungsten

Frequency	f	< 600	600 to 750	750 to 900	MHz
Filament voltage	V_f	= 3.4	3.3	3.2	V
Filament current	I_f	= 19	–	–	A

CAPACITANCES

Anode to all except grid	C_a	<	0.12	pF
Grid to all except anode	C_g	=	11.5	pF
Anode to grid	C_{ag}	=	6.5	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	2000	V
Anode current	I_a	=	200	mA
Amplification factor	μ	=	33	
Mutual conductance	S	=	10	mA/V

TEMPERATURE LIMITS (Absolute limits)

Temperature of seal between filament terminals = max. 200 °C

Temperature of other seals = max. 250 °C

COOLING CHARACTERISTICS

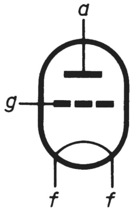
W_a (W)	h (m)	t_i (°C)	q_{min} (m^3/min)	p_i (mm H_2O)
400	0	45	0.65	12
	1500	35	0.65	12
	3000	25	0.65	12

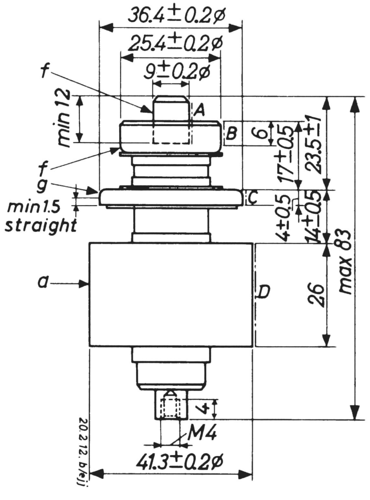
The required quantity of air is independent of the anode dissipation and the frequency.

MECHANICAL DATA

Dimensions in mm

Net weight: 157 g




36.4±0.2⌀
25.4±0.2⌀
9±0.2⌀
f
min 12
A
B
6
17±0.5
23.5±1
f
g
min1.5
straight
C
4±0.5
14±0.5
max 83
a
D
26
4
M4
41.3±0.2⌀
20.2.12. b/ej

Eccentricity of the electrode connections: The electrode connections A, B and C are within cylindrical surfaces having a diameter of 9.5, 25.9 and 36.9 mm respectively and being concentric with the cylindrical surface D.

Mounting position: vertical with the anode up or down.

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

Frequency	f	up to	470	600	900	MHz
Anode voltage	V_a	= max.	2200	2100	2000	V
Anode current	I_a	= max.	400	400	400	mA
Anode input power	W_{i_a}	= max.	880	840	800	W
Anode dissipation	W_a	= max.	400	400	400	W
Negative grid voltage	$-V_g$	= max.	300	300	300	V
Grid current	I_g	= max.	120	120	120	mA

OPERATING CONDITIONS in grounded grid circuit

Frequency	f	=	470	640	730	810	MHz
Anode voltage	V_a	=	2000	1800	1800	1800	V ¹)
Anode current	I_a	=	400	400	400	400	mA
Grid voltage	V_g	=	-140	-120	-120	-120	V
Grid current	I_g	=	120	100	100	100	mA
Grid input power	W_{i_g}	=	120	105	105	105	W
Anode input power	W_{i_a}	=	800	720	720	720	W
Anode dissipation	W_a	=	290	310	340	392	W
Output power	W_o	=	510+85	410+80	380+80	328+80	W ²)
Tube efficiency	η	=	63.5	57	53	45.5	%

---

¹) With respect to cathode

²) Power transferred from driving stage included

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

LIMITING VALUES (Absolute limits)

Frequency	f	up to	470	900	MHz
Anode voltage	V_a	= max.	2200	2000	V
Anode current	I_a	= max.	400	400	mA
Anode input power	W_{i_a}	= max.	880	800	W
Anode dissipation	W_a	= max.	400	400	W
Negative grid voltage	$-V_g$	= max.	300	300	V
Grid current, loaded	I_g	= max.	120	120	mA
Grid current, unloaded	I_g	= max.	130	130	mA
Grid circuit resistance	R_g	= max.	10	10	kΩ

OPERATING CONDITIONS

Frequency	f	=	470	810	MHz
Anode voltage	V_a	=	2000	1800	V
Anode current, loaded	I_a	=	380	380	mA
Anode current, unloaded	I_a	=	170	-	mA
Grid circuit resistance	R_g	=	1000	1000	Ω 1)
Grid current, loaded	I_g	=	110	110	mA
Grid current, unloaded	I_g	=	120	120	mA
Anode input power	W_{i_a}	=	760	684	W
Anode dissipation	W_a	=	280	400	W
Tube output power	W_o	=	480	284	W
Tube efficiency	η	=	63	41	%
Output power in the load	W_ℓ	=	340	200	W

---

1) The grid circuit resistance is obtained by a current stabilising device. The stated value applies to loaded conditions.

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE in grounded grid circuit with self rectification

LIMITING VALUES (Absolute limits)

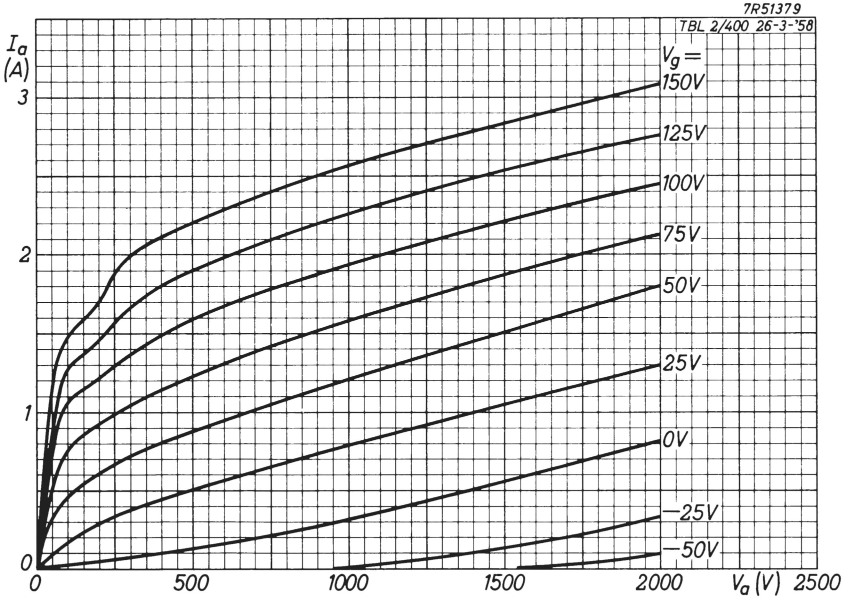
Voltages with respect to cathode

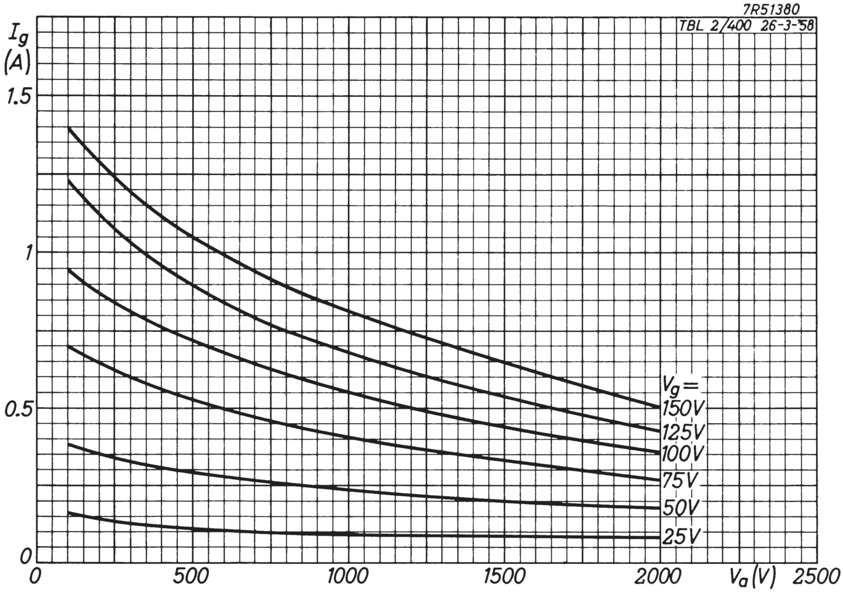
Frequency	f	up to	470	MHz
Transformer voltage	V_{tr}	= max.	2000	V(RMS)
Anode current	I_a	= max.	210	mA
Anode input power	W_{i_a}	= max.	450	W
Anode dissipation	W_a	= max.	170	W
Negative grid voltage	$-V_g$	= max.	300	V
Grid current, loaded	I_g	= max.	85	mA
Grid current, unloaded	I_g	= max.	120	mA
Grid circuit resistance	R_g	= max.	5	kΩ

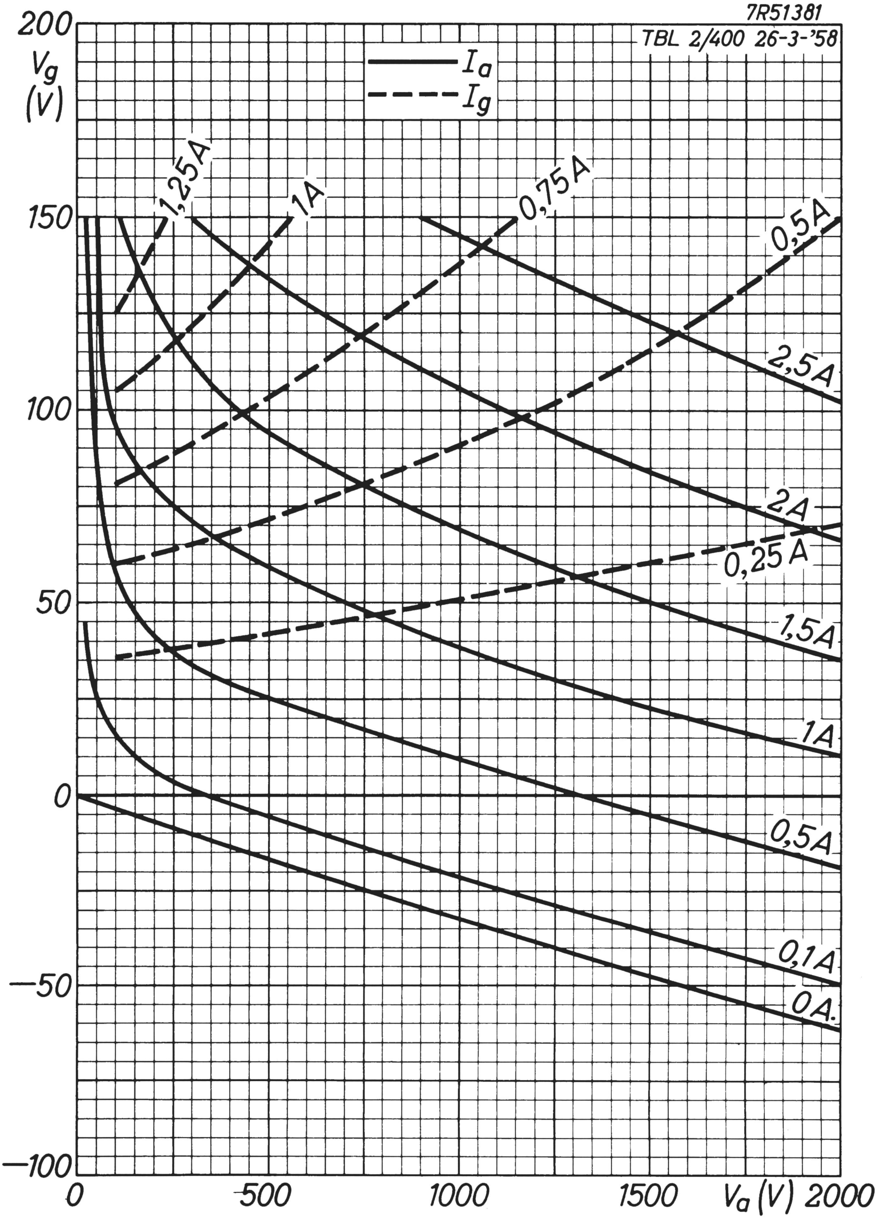
OPERATING CHARACTERISTICS

Voltages with respect to cathode

Frequency	f	=	470	MHz
Transformer voltage	V_{tr}	=	1800	V(RMS)
Anode current, loaded	I_a	=	190	mA
Anode current, unloaded	I_a	=	110	mA
Grid current, loaded	I_g	=	70	mA
Grid current, unloaded	I_g	=	100	mA
Grid circuit resistance	R_g	=	400	Ω
Anode input power	W_{i_a}	=	380	W
Anode dissipation	W_a	=	150	W
Tube output power	W_o	=	230	W
Tube efficiency	η	=	60	%
Output power in the load	W_ℓ	=	160	W


7R51379
TBL 2/400 26-3-'58
I_a (A)
3
2
1
0
0
500
1000
1500
2000
V_a (V)
2500
V_g =
150V
125V
100V
75V
50V
25V
0V
−25V
−50V


7R51380
TBL 2/400 26-3-'58
I_g (A)
1.5
1
0.5
0
0
500
1000
1500
2000
V_a (V)
2500
V_g =
150V
125V
100V
75V
50V
25V


7R51381
TBL 2/400 26-3-'58
I_a
I_g
200
V_g
(V)
150
100
50
0
−50
−100
1,25A
1A
0,75A
0,5A
2,5A
2A
0,25 A
1,5A
1A
0,5A
0,1A
0A
0
500
1000
1500
V_a (V) 2000

AIR COOLED COAXIAL R.F. POWER TRIODE

QUICK REFERENCE DATA		
Frequency (MHz)	C telegr. grounded grid	
	V_a (V)	W_o (W)
400	2500	670
625	2200	580

HEATING : direct; filament thoriated tungsten

Frequency	f	< 600	600 to 750	> 750	MHz
Filament voltage	V_f	= 3.4	3.3	3.2	V
Filament current	I_f	= 19	-	-	A

CAPACITANCES

Anode to all except grid	C_a	= 0.05	pF
Grid to all except anode	C_g	= 11	pF
Anode to grid	C_{ag}	= 3.8	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	= 2400	V
Anode current	I_a	= 240	mA
Amplification factor	μ	= 70	
Mutual conductance	S	= 14	mA/V

TEMPERATURE LIMITS (Absolute limits)

Temperature of envelope = max. 200 °C

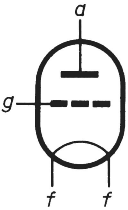
COOLING CHARACTERISTICS

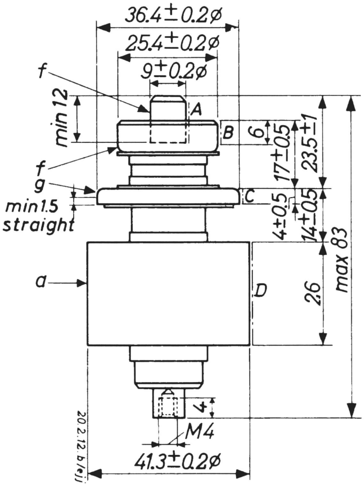
W_a (W)	h (m)	t_i (°C)	q_{min} (m^3/min)	p_i (mm H_2O)
500	0	45	0.9	24
	1500	35	0.9	20
	3000	25	1.0	21

MECHANICAL DATA

Dimensions in mm

Net weight: 157 g




36.4±0.2∅
25.4±0.2∅
9±0.2∅
f
A
min 12
B
6
17±0.5
23.5±1
f
g
min1.5
straight
C
4±0.5
14±0.5
max 83
a
D
26
4
M4
41.3±0.2∅
20.2.12.b/e(1)

Eccentricity of the electrode connections: The electrode connections A, B and C are within cylindrical surfaces having a diameter of 9.5, 25.9 and 36.9 mm respectively and being concentric with the cylindrical surface D.

Mounting position: vertical with the anode up or down

R.F. CLASS C TELEGRAPHY or F.M. TELEPHONY

LIMITING VALUES (Absolute limits)

Frequency	f	up to	400	625	940	MHz
Anode voltage	V_a	= max.	2700	2500	2000	V
Anode current	I_a	= max.	400	400	400	mA
Anode input power	W_{ia}	= max.	1000	880	800	W
Anode dissipation	W_a	= max.	500	500	500	W
Negative grid voltage	$-V_g$	= max.	300	300	300	V
Grid current	I_g	= max.	175	175	160	mA

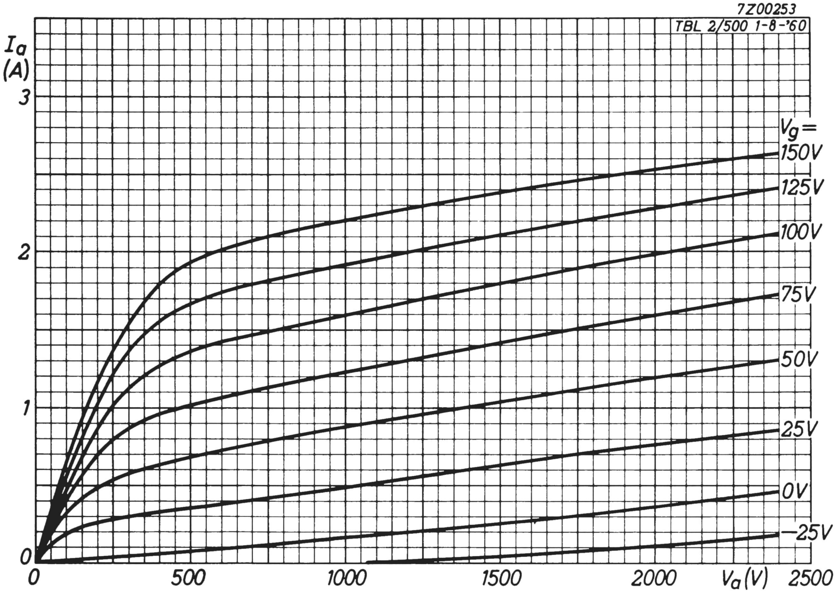
OPERATING CONDITIONS in grounded grid circuit

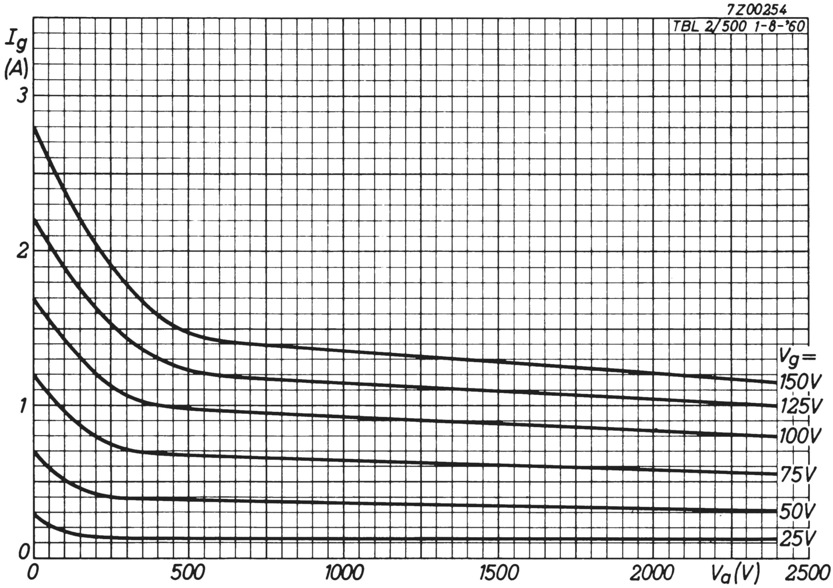
Frequency	f	=	400	625	MHz
Anode voltage	V_a	=	2500	2200	V
Negative grid voltage	$-V_g$	=	70	60	V
Anode current	I_a	=	380	380	mA
Grid current	I_g	=	160	170	mA
Grid input power	W_{ig}	=	70	65	W
Anode input power	W_{ia}	=	950	835	W
Anode dissipation	W_a	=	330	302	W
Tube output power	W_o	=	620+50	533+47	W [1]
Tube efficiency	η	=	65	64	%
Output power in the load	W_ℓ	=	470	405	W [2]
Power gain	W_o/W_i	=	9.6	8.9	

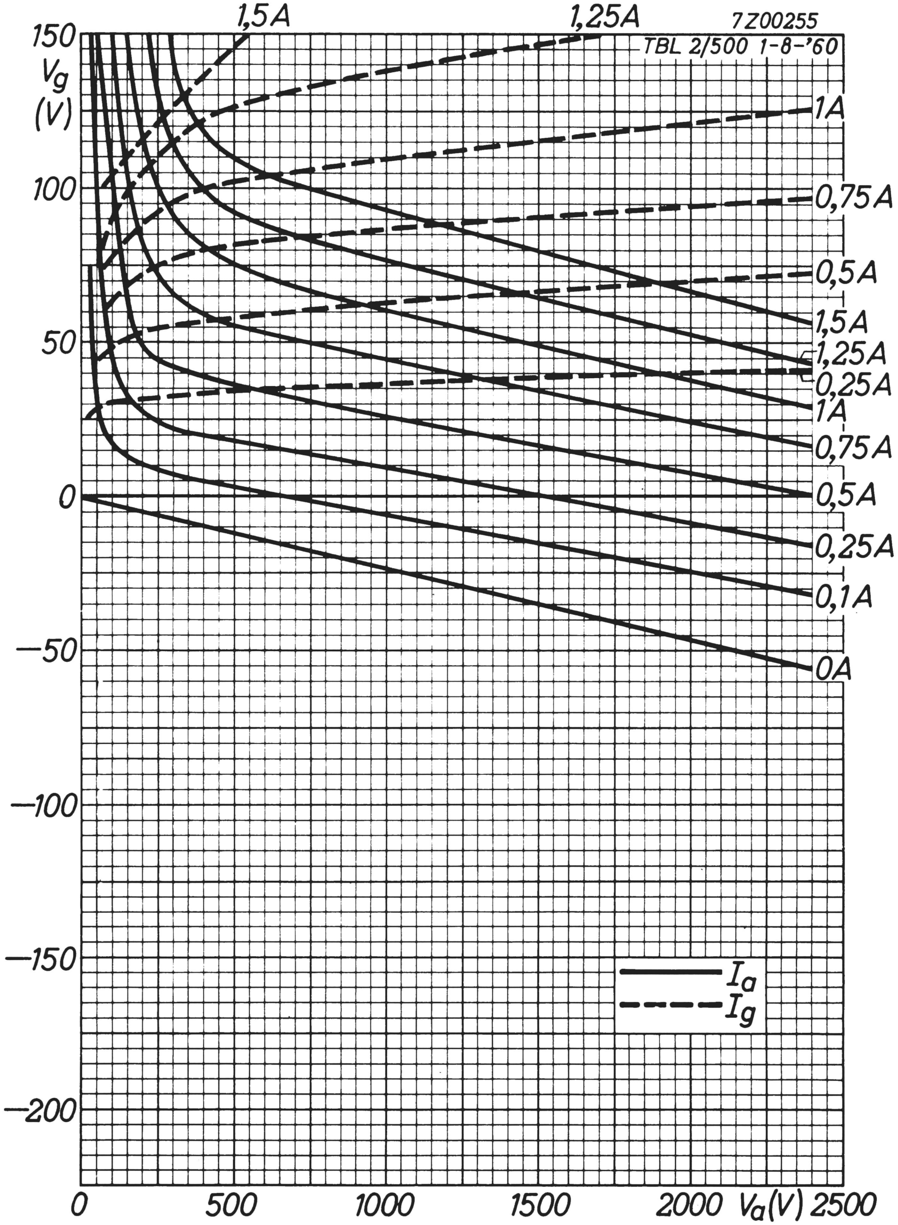
---

[1] Power transferred from driving stage included

[2] Measured in a circuit having an efficiency of 70%


7Z00253
TBL 2/500 1-8-'60
I_a (A)
3
2
1
0
0
500
1000
1500
2000
V_a(V)
2500
V_g=
150V
125V
100V
75V
50V
25V
0V
−25V


7Z00254
TBL 2/500 1-8-'60
I_g (A)
3
2
1
0
0
500
1000
1500
2000
V_a(V)
2500
V_g=
150V
125V
100V
75V
50V
25V


7Z00255
TBL 2/500 1-8-'60
1,5A
1,25A
1A
0,75A
0,5A
1,5A
1,25A
0,25A
1A
0,75A
0,5A
0,25A
0,1A
0A
150
V_g
(V)
100
50
0
−50
−100
−150
−200
0
500
1000
1500
2000
V_a(V)
2500
I_a
I_g

AIR COOLED
INDUSTRIAL R.F. POWER TRIODE

QUICK REFERENCE DATA		
Industrial R.F. oscillator class C		
Freq. (MHz)	three phase	
	V_a (kV)	W_o (kW)
30	7 6	17.7 14.3

HEATING: direct, filament thoriated tungsten

Filament voltage	V_f	=	6.3	V	+ 5 % -10 %
Filament current	I_f	=	130	A	
Cold filament resistance	R_{fo}	=	0.005	Ω	

The filament current must never exceed a peak value of 280 A at any time during the initial energizing schedule

CAPACITANCES

Anode to all other elements except grid	C_a	=	1.2	pF
Grid to all other elements except anode	C_g	=	44.5	pF
Anode to grid	C_{ag}	=	33.5	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	6	kV
Anode current	I_a	=	2.5	A
Mutual conductance	S	=	23	mA/V
Amplification factor	μ	=	17.5	

TEMPERATURE LIMITS (Absolute limits)

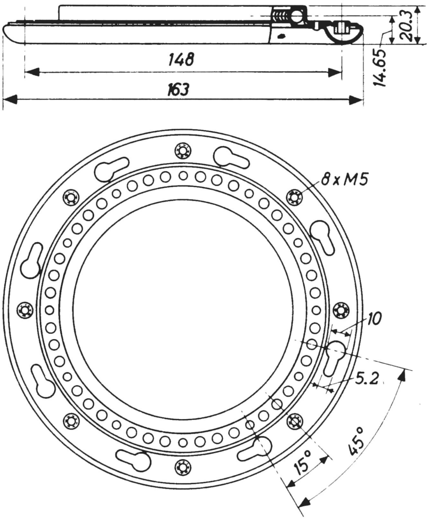
Temperature of all seals = max. 220 °C

AIR COOLING CHARACTERISTICS

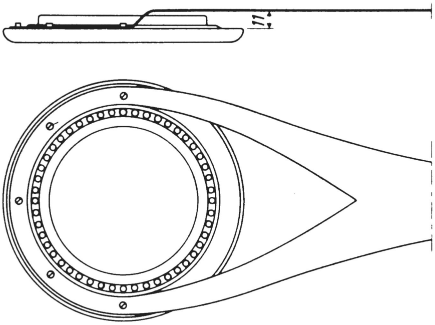
W_a (kW)	h (m)	t_i (°C)	q_{min} (m^3/min)	p_i (mm H_2O)
5	0	45	5.9	15
	0	35	5.2	12
	1500	35	6.2	14
	3000	25	6.6	15
7.5	0	45	9.0	34
	0	35	8.0	27
	1500	35	9.5	32
	3000	25	10.2	34
10	0	45	12.3	63
	0	35	11	50
	1500	35	13	59
	3000	25	14	64

MECHANICAL DATA

Dimensions in mm



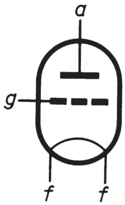
Grid connector 40664

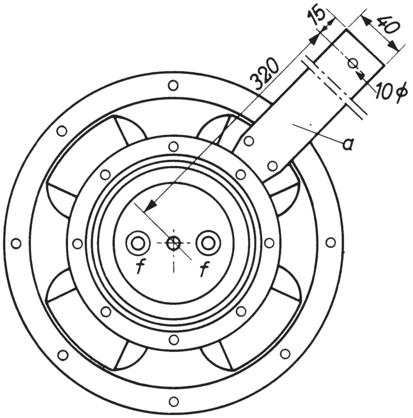


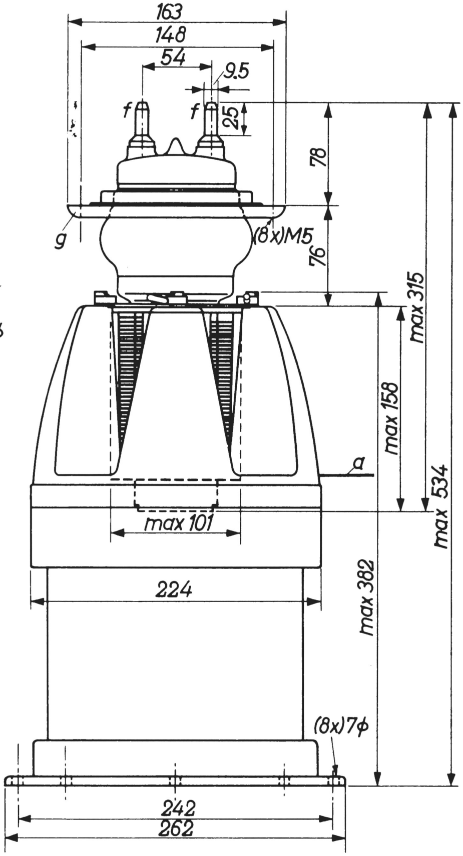
Connection of the grid lead

The rounded side of the grid connector should face the anode. To ensure a uniform R.F. current distribution in the grid seal at frequencies higher than 4 MHz, the grid lead should be connected as shown in the figure at right

MECHANICAL DATA (continued)




15
40
320
10 ϕ
a
f
f


163
148
54
9.5
f
f
25
78
g
(8x)M5
76
max 315
max 158
a
max 534
max 101
224
max 382
(8x)7ϕ
242
262

ACCESSORIES

Filament connectors
with cable : 40662

Grid connector : 40664

Insulating pedestal : K508
or air distributor : K509

Net weight of tube : 3.8 kg

Net weight of pedestal: 7.4 kg

Dimensions in mm

Mounting position: vertical with anode down

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from three-phase rectifier without filter

LIMITING VALUES (Absolute limits)

Frequency	f		up to	30	MHz
Anode voltage	V_a	=	max.	8	kV
Anode input power	W_{ia}	=	max.	30	kW
Anode dissipation	W_a	=	max.	10	kW [1]
Anode dissipation	W_a	=	max.	15	kW [2]
Anode current	I_a	=	max.	4.0	A
Negative grid voltage	$-V_g$	=	max.	1600	V
Grid current, loaded	I_g	=	max.	1.5	A
Grid current, unloaded	I_g	=	max.	2.0	A
Grid circuit resistance	R_g	=	max.	10	kΩ

OPERATING CONDITIONS

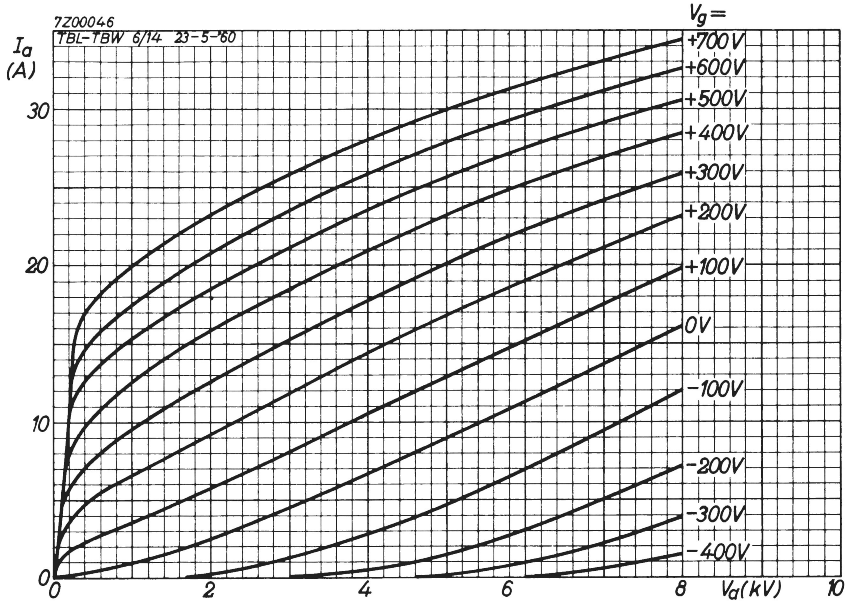
Frequency	f	=	30	30	MHz
Anode voltage	V_a	=	7	6	kV
Anode current, loaded	I_a	=	3.5	3.3	A
Anode current, unloaded	I_a	=	0.7	0.51	A
Grid current, loaded	I_g	=	0.95	0.8	A
Grid current, unloaded	I_g	=	1.35	1.1	A
Grid resistor	R_g	=	950	1000	Ω
Load resistance	$R_{a\sim}$	=	1000	870	Ω
Feedback ratio under loaded conditions	$V_{g\sim}/V_{a\sim}$	=	25	26	%
Anode input power	W_{ia}	=	24.5	19.8	kW
Anode dissipation	W_a	=	6.8	5.5	kW
Output power	W_o	=	17.7	14.3	kW
Efficiency	η	=	72	72	%
Output power in the load	W_ℓ	=	14	11	kW [3]

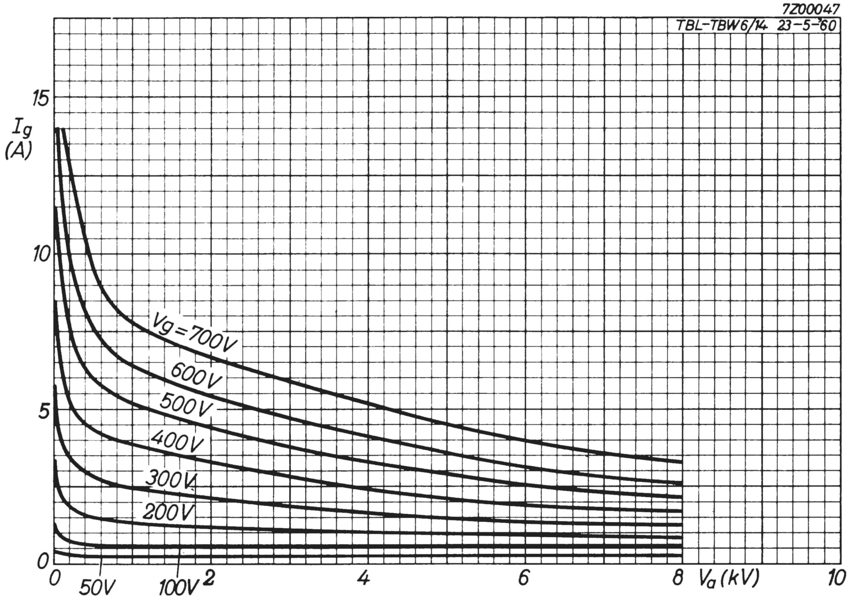
---

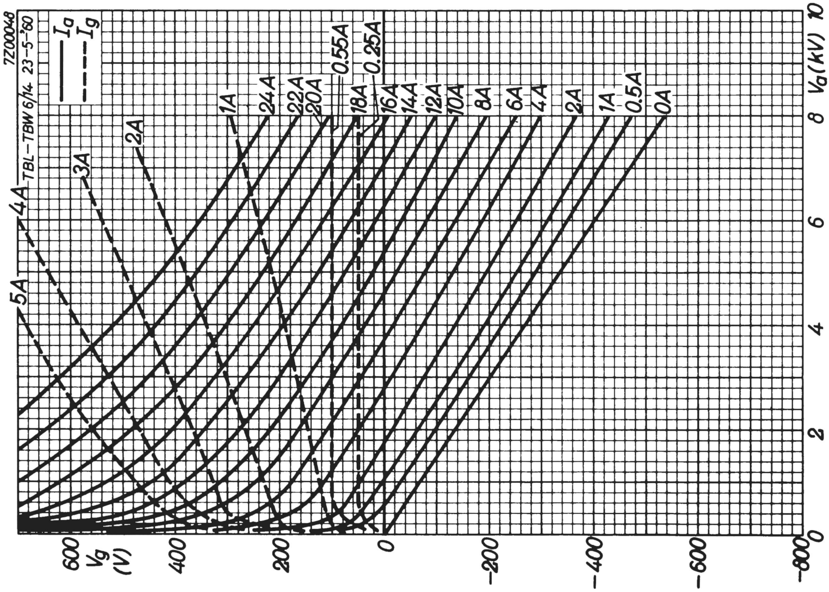
[1] Continuous service with adequate cooling.

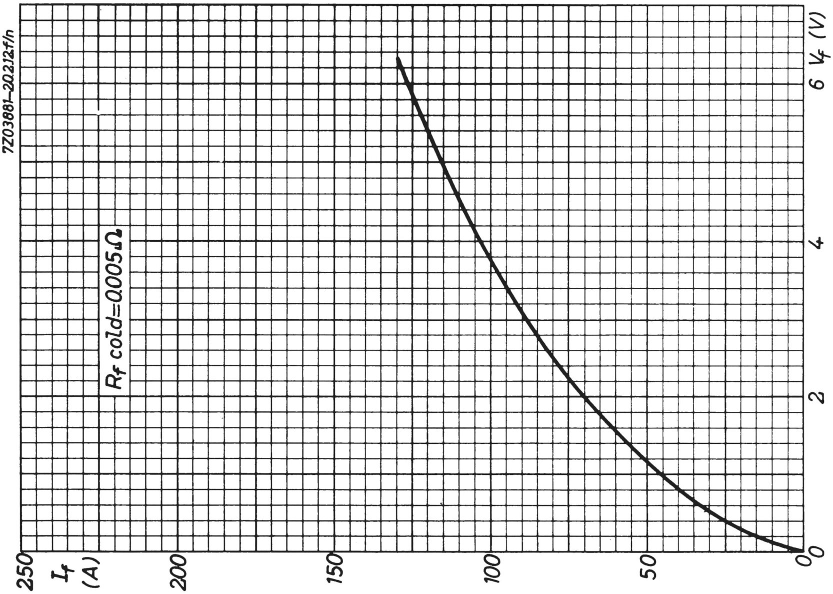
[2] Intermittent service. See also page 7.

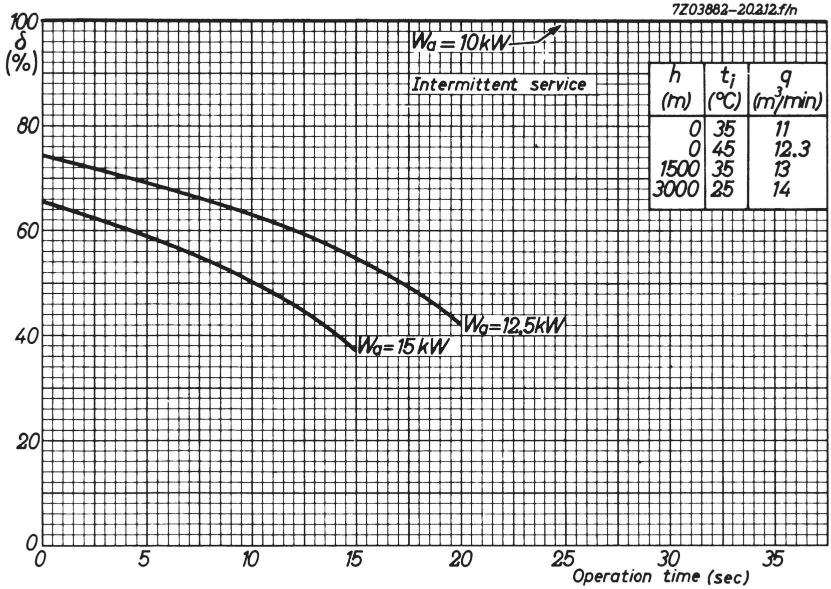
[3] Useful power in the load, measured in a circuit having an efficiency of about 85%.

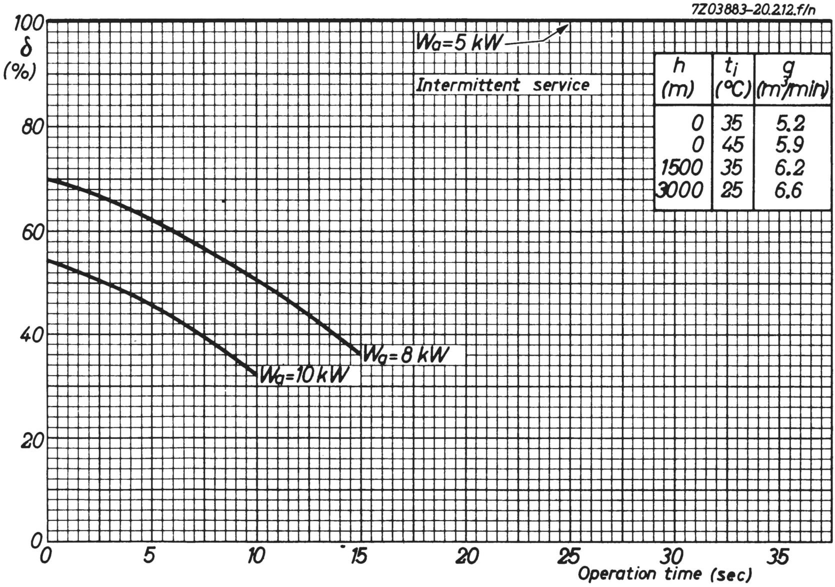

7Z00046
TBL-TBW 6/14 23-5-'60
I_a (A)
30
20
10
0
V_g =
+700V
+600V
+500V
+400V
+300V
+200V
+100V
0V
-100V
-200V
-300V
-400V
0
2
4
6
8
V_a (kV)
10

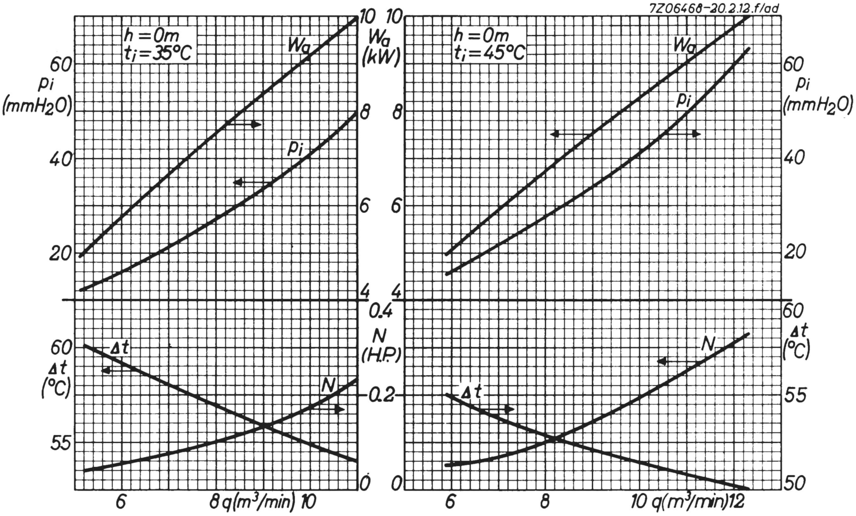

7Z00047
TBL-TBW 6/14 23-5-'60
15
I_g (A)
10
5
0
Vg=700V
600V
500V
400V
300V
200V
50V
100V
0
2
4
6
8
V_a (kV)
10

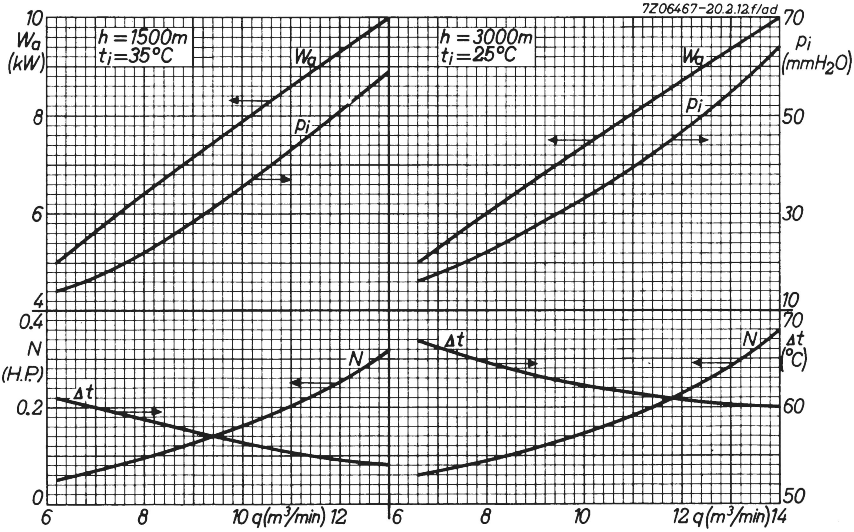

7Z00048
TBL-TBW 6/14 23-5-'60
I_a
I_g
5A
4A
3A
2A
1A
24A
22A
20A
0.55A
18A
0.25A
16A
14A
12A
10A
8A
6A
4A
2A
1A
0.5A
0A
V_g (V)
600
400
200
0
-200
-400
-600
-800
V_a (kV)
0
2
4
6
8
10


7Z03881-20.2.12f/n
R_f cold=0.005Ω
I_f (A)
250
200
150
100
50
0
V_f (V)
0
2
4
6


7Z03882-20.2.12.f/n
100
δ
(%)
80
60
40
20
0
0
5
10
15
20
25
30
35
Operation time (sec)
Wa = 10kW
Intermittent service
h (m)
ti (°C)
q (m³/min)
0 35 11
0 45 12.3
1500 35 13
3000 25 14
Wa=12,5kW
Wa= 15 kW


7Z03883-20.2.12.f/n
100
δ
(%)
80
60
40
20
0
0
5
10
15
20
25
30
35
Operation time (sec)
Wa=5 kW
Intermittent service
h (m)
ti (°C)
q (m³/min)
0 35 5.2
0 45 5.9
1500 35 6.2
3000 25 6.6
Wa=8 kW
Wa=10 kW


7Z06468-20.2.12.f/ad
h = 0m
t_i = 35°C
h = 0m
t_i = 45°C
W_a
p_i
p_i (mmH$_2$O)
W_a (kW)
Δt (°C)
N (H.P.)
Δt
N
60
40
20
10
8
6
4
0.4
0.2
0
55
50
6
8
10
12
q (m^3/min)


7Z06467-20.2.12.f/ad
h = 1500m
t_i = 35°C
h = 3000m
t_i = 25°C
W_a
p_i
W_a (kW)
p_i (mmH$_2$O)
N (H.P.)
Δt (°C)
Δt
N
10
8
6
4
0.4
0.2
0
70
50
30
10
60
6
8
10
12
14
q (m^3/min)

AIR COOLED
COAXIAL R.F. POWER TRIODE

QUICK REFERENCE DATA						
Freq. (MHz)	C telegr. grounded grid		B television			
			Neg. mod. Pos. sync.		Pos. mod. Neg. sync.	
	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW) sync.	V_a (kV)	W_o (kW) white
110	5	17				
48 to 88			5	17	5	17
170 to 220			4	12	4	12

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	6.3	V
Filament current	I_f	=	154	A
Cold filament resistance	R_{fo}	=	0.0054	Ω

The filament current must never exceed a peak value of 500 A at any time during the initial energizing schedule

CAPACITANCES

Anode to all other elements except grid	C_a	=	0.6	pF [1]
Grid to all other elements except anode	C_g	=	65	pF
Anode to grid	C_{ag}	=	29	pF

TYPICAL CHARACTERISTICS

Anode current	I_a	=	1	A
Anode voltage	V_a	=	4	kV
Amplification factor	μ	=	60	
Mutual conductance	S	=	60	mA/V

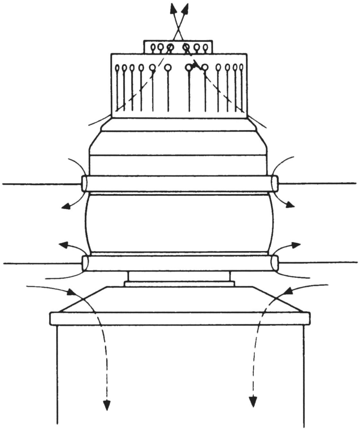
---

[1] Anode fully screened from filament terminals by a flat metal screen connected to the grid terminal

AIR COOLING CHARACTERISTICS. See also cooling curves

W_a (kW)	h (m)	t_i (°C)	q_{min} (m^3/min)	p_i (mm H_2O)
5.5	0	35	5.0	16
	1500	35	5.9	16
	3000	25	5.7	16
8	0	35	7.7	35
	1500	35	9	40
	3000	25	9	36
10	0	35	11	65
	1500	35	13	75
	3000	25	13	66

Recommended direction of air flow



Generally it is necessary to direct an air flow on the grid, anode and filament seals. E.g. at 220 MHz an air flow of 0.6 m^3/min on each of these seals is necessary.

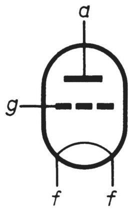
TEMPERATURE LIMITS (Absolute limits)

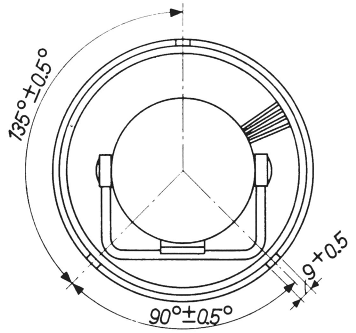
Temperature of seals = max. 180 °C

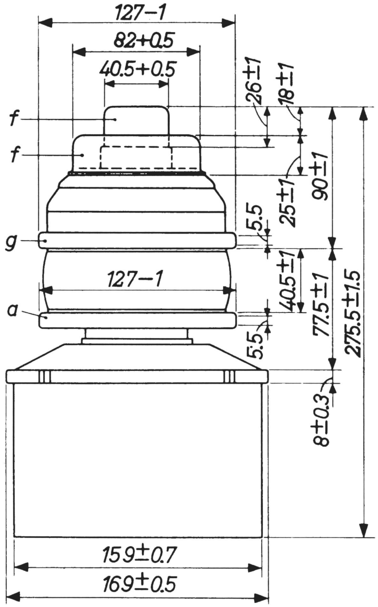
MECHANICAL DATA

Dimensions in mm

Net weight: 9.5 kg




135°±0.5°
9+0.5
90°±0.5°


127−1
82+0.5
40.5+0.5
26±1
18±1
f
f
g
a
5.5
25±1
90±1
127−1
40.5±1
77.5±1
275.5±1.5
5.5
8±0.3
159±0.7
169±0.5

Eccentricity of outer diameters of the electrode terminals and of the protruding edge of the radiator housing with respect to the radiator housing is max. 1 mm

Mounting position: vertical with anode up or down

ACCESSORIES

Insulating pedestal	40654
Grid and anode connector	40651
Inner filament connector	40652
Outer filament connector	40653

R.F. CLASS C TELEGRAPHY , grounded grid

LIMITING VALUES (Absolute limits)

Frequency	f		up to 110	MHz
Anode voltage	V_a	=	max. 5.5	kV
Negative grid voltage	$-V_g$	=	max. 500	V
Anode current	I_a	=	max. 6	A
Grid current	I_g	=	max. 1.5	A
Anode input power	W_{ia}	=	max. 30	kW
Anode dissipation	W_a	=	max. 10	kW

OPERATING CONDITIONS

Frequency	f	=	110	MHz
Anode voltage	V_a	=	5	kV
Grid voltage	V_g	=	-300	V
Anode current	I_a	=	4.8	A
Grid current	I_g	=	1.2	A
Peak grid A.C. voltage	V_{g_p}	=	520	V
Grid input power	W_{ig}	=	2560	W
Anode input power	W_{ia}	=	24	kW
Anode dissipation	W_a	=	9	kW
Output power	W_o	=	15 + 2	kW[1]
Efficiency	η	=	62.5	% [2]

---

[1] Power transferred from driving stage included

[2] Pure tube **efficiency**

R.F. CLASS B TELEPHONY FOR TELEVISION SERVICE; linear, grounded-grid amplifier
Negative modulation, positive synchronisation (CCIR and FCC system)

LIMITING VALUES (Absolute limits)

Frequency	f			up to 88	up to 220	MHz
Anode voltage	V_a		=	max. 5.5	max. 4.5	kV
Anode input power	W_{ia}	sync	=	max. 25	max. 22	kW
Anode dissipation	W_a	sync	=	max. 10	max. 10	kW
Anode current	I_a	sync	=	max. 6	max. 6	A
Grid current	I_g	sync	=	max. 1.2	max. 1.2	A

OPERATING CONDITIONS (at centre frequency of the resonance curve)

Frequency	f		=	48 to 88	170 to 220	MHz
Bandwidth	B (−1.5 dB)		=	−	7	MHz
Bandwidth	B (−3 dB)		=	6	12	MHz
Anode voltage	V_a		=	5	4	kV
Grid voltage	V_g		=	−90	−75	V
Peak grid A.C. voltage	V_{gp}	sync	=	270	255	V
		black	=	200	180	V
Anode current	I_a	sync	=	4.8	4.8	A
		black	=	3.6	3.6	A
Grid current	I_g	sync	=	1.0	1.0	A
		black	=	0.35	0.35	A
Grid input power	W_{ig}	sync	=	1.4	1.3	kW
Output power	W_o	sync	=	17	12	kW
		black	=	9.6	6.75	kW

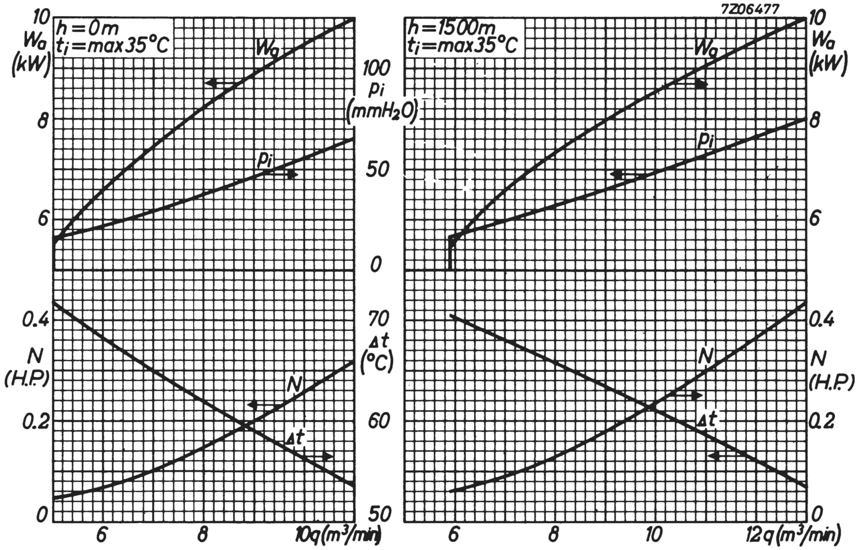
R.F. CLASS B TELEPHONY FOR TELEVISION SERVICE ; linear, grounded-grid amplifier
Positive modulation, negative synchronisation (RTF and BBC system)

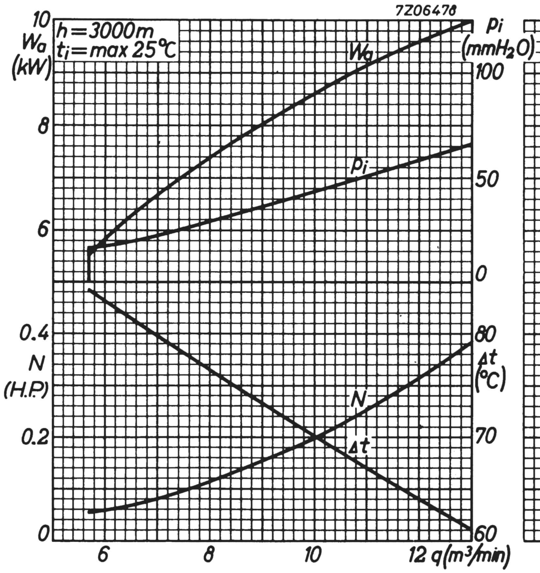
LIMITING VALUES (Absolute limits)

Frequency	f			up to 88	up to 220	MHz
Anode voltage	V_a		=	max. 5.5	max. 4.5	kV
Anode input power	W_{ia}	white	=	max. 25	max. 22	kW
Anode current	I_a	white	=	max. 6	max. 6	A
Grid current	I_g	white	=	max. 1.2	max. 1.2	A
Anode dissipation	W_a	white	=	max. 10	max. 10	kW

OPERATING CONDITIONS (at centre frequency of the resonance curve)

Frequency	f		=	48 to 88	170 to 220	MHz
Bandwidth	B (−3 dB)		=	6	12	MHz
Anode voltage	V_a		=	5	4	kV
Grid voltage	V_g		=	−90	−75	V
Peak grid A.C. voltage	V_{gp}	white	=	270	255	V
		black	=	110	95	V
Anode current	I_a	white	=	4.8	4.8	A
		black	=	1.45	1.45	A
Grid current	I_g	white	=	1	1	A
		black	=	0.2	0.2	A
Grid input power	W_{ig}	white	=	1.4	1.3	kW
Output power	W_o	white	=	17	12	kW
		black	=	1.7	1.2	kW


7Z06477
h=0m
t_i=max 35°C
Wa (kW)
10
8
6
0.4
N (H.P)
0.2
0
Wa
p_i
N
Δt
p_i (mmH2O)
100
50
0
Δt (°C)
70
60
50
6
8
10 q (m³/min)
h=1500m
t_i=max 35°C
Wa
p_i
N
Δt
10
Wa (kW)
8
6
0.4
N (H.P)
0.2
0
6
8
10
12 q (m³/min)


7Z06478
h=3000m
t_i=max 25°C
Wa (kW)
10
8
6
0.4
N (H.P)
0.2
0
Wa
p_i
N
Δt
p_i (mmH2O)
100
50
0
80
Δt (°C)
70
60
6
8
10
12 q (m³/min)

AIR COOLED
INDUSTRIAL R.F. POWER TRIODE

QUICK REFERENCE DATA				
Industrial R.F. oscillator class C				
Freq. (MHz)	Three phase rectifier			
	Continuous		Intermittent	
	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)
50	7	4.85		
	6	4.1	6	5.9

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	6.3	V $^{+5\%}_{-10\%}$
Filament current	I_f	=	65	A

CAPACITANCES

Anode to all other elements except grid	C_a	<	0.5	pF
Grid to all other elements except anode	C_g	=	13	pF
Anode to grid	C_{ag}	=	7.5	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	6	kV
Anode current	I_a	=	0.24	A
Amplification factor	μ	=	23	
Mutual conductance	S	=	7	mA/V

TEMPERATURE LIMITS (Absolute limits)

Temperature of all seals	= max.	220	°C
Temperature of external parts of the anode	= max.	270	°C

7Z2 3531

COOLING

Continuous service

W_a (kW)	q_{min} (m^3/min)	p_i (mm H_2O)
1.3	1.6	16
1.7	2.1	25

For intermittent service see **figure page** A

At higher altitudes and/or temperatures a corresponding higher amount of air should be applied

RECOMMENDED COOLING DEVICE

(1) = metal housing (see page 3)

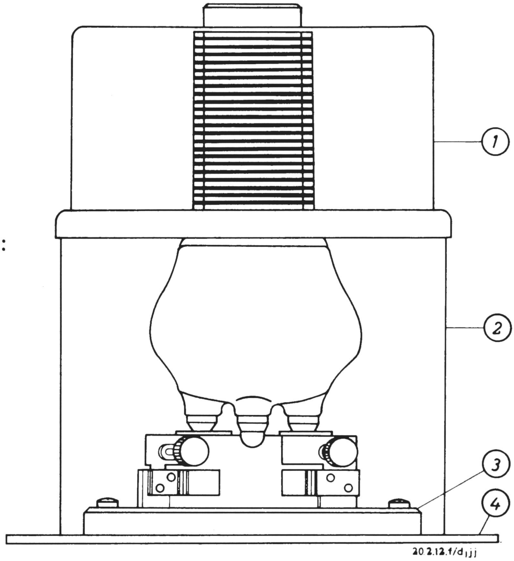
(2) = glass cylinder

(3) = socket 2422 511 05001

(4) = ground plate (see page 3)

Dimensions of the glass cylinder:

Height	: 118 mm
Outside diameter	: 150 mm
Inside diameter	: 144 mm



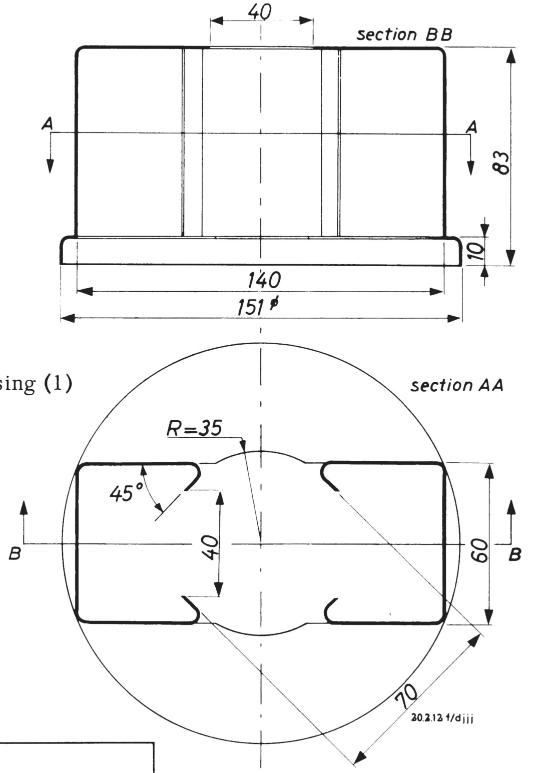
The cooling air should preferably be supplied through the space under the ground plate (4). This ground plate should have holes of sufficient cross section to pass the required air flow.

The housing (1) should be connected to the anode connector. At frequencies above 4 MHz both grid terminals should be connected in parallel. At the highest frequencies care should be taken to distribute the R.F. current equally between both grid terminals to avoid excessive grid seal temperatures.

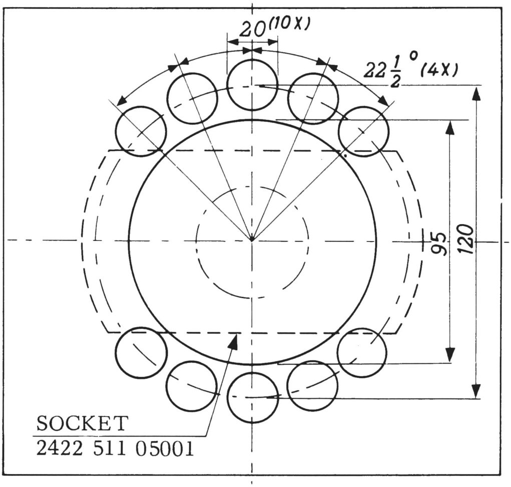
RECOMMENDED COOLING DEVICE (continued)

Dimensions in mm

Metal housing (1)


40
section BB
A
A
83
10
140
151 ⌀
section AA
R=35
45°
40
60
B
B
70
20.2.12 f/djjj

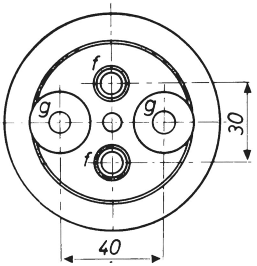
Ground plate (4)

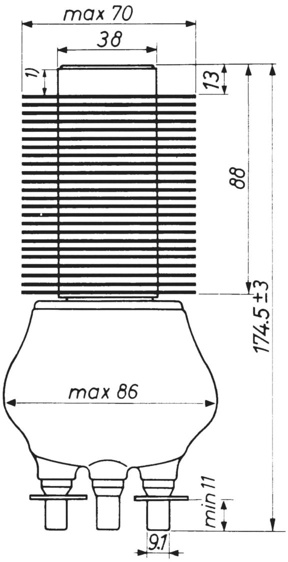

20 (10X)
22 ½ ° (4X)
95
120
SOCKET
2422 511 05001

7Z2 8656

MECHANICAL DATA (dimensions in mm)

Socket: 2422 511 05001




max 70
38
1)
13
88
174.5 ±3
max 86
min 11
9.1

Mounting position: vertical with anode up or down

---

[1] Area for anode connector

7Z2 8657

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from three-phase rectifier without filter

LIMITING VALUES (Absolute limits) continuous service

Frequency	f	up to	50	MHz
Anode voltage	V_a	= max.	8	kV
Anode current	I_a	= max.	1	A
Anode input power	W_{ia}	= max.	7	kW
Anode dissipation	W_a	= max.	1.7	kW
Negative grid voltage	$-V_g$	= max.	1250	V
Grid current, loaded	I_g	= max.	0.4	A
Grid current, unloaded	I_g	= max.	0.5	A
Grid resistor	R_g	= max.	10	kΩ

OPERATING CONDITIONS, continuous service

Frequency	f	=	50	50	MHz
Transformer voltage	V_{tr}	=	6.0	5.1	kV_{RMS}
Anode voltage	V_a	=	7	6	kV
Anode current, loaded	I_a	=	0.9	0.9	A
Anode current, unloaded	I_a	=	0.2	0.2	A 1)
Grid current, loaded	I_g	=	0.25	0.28	A
Grid current, unloaded	I_g	=	0.30	0.35	A 1)
Grid resistor	R_g	=	2.5	2	kΩ
Load resistance	$R_{a\sim}$	=	3.85	3.3	kΩ
Feedback ratio under loaded conditions	$V_{g\sim}/V_{a\sim}$	=	15	16	%
Anode input power	W_{ia}	=	6.3	5.4	kW
Anode dissipation	W_a	=	1.45	1.3	kW
Output power	W_o	=	4.85	4.1	kW
Efficiency	η	=	77	76	%
Output power in the load	W_ℓ	=	4.0	3.3	kW 2)

---

1) In a typical circuit

2) Useful power in the load measured in a circuit having an efficiency of 85%.

7Z2 3535

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from three-phase rectifier without filter

LIMITING VALUES (Absolute limits) intermittent service

Frequency	f	up to	50	MHz
Anode voltage	V_a	= max.	8	kV
Anode current	I_a	= max.	1.5	A
Anode input power	W_{ia}	= max.	9	kW
Anode dissipation	W_a	= max.	2.1	kW [1]
Negative grid voltage	$-V_g$	= max.	1250	V
Grid current, loaded	I_g	= max.	0.4	A
Grid current, unloaded	I_g	= max.	0.5	A
Grid resistor	R_g	= max.	10	kΩ

OPERATING CONDITIONS, intermittent service

Frequency	f	=	50	MHz
Transformer voltage	V_{tr}	=	5.1	kV_{RMS}
Anode voltage	V_a	=	6	kV
Anode current, loaded	I_a	=	1.33	A
Anode current, unloaded	I_a	=	0.33	A [2]
Grid current, loaded	I_g	=	0.38	A
Grid current, unloaded	I_g	=	0.48	A [2]
Grid resistor	R_g	=	1450	Ω
Load resistance	$R_{a\sim}$	=	2200	Ω
Feedback ratio under loaded conditions	$V_{g\sim}/V_{a\sim}$	=	17	%
Anode input power	W_{ia}	=	8	kW
Anode dissipation	W_a	=	2.1	kW [1]
Output power	W_o	=	5.9	kW
Efficiency	η	=	74	%
Output power in the load	W_ℓ	=	4.75	kW [3]

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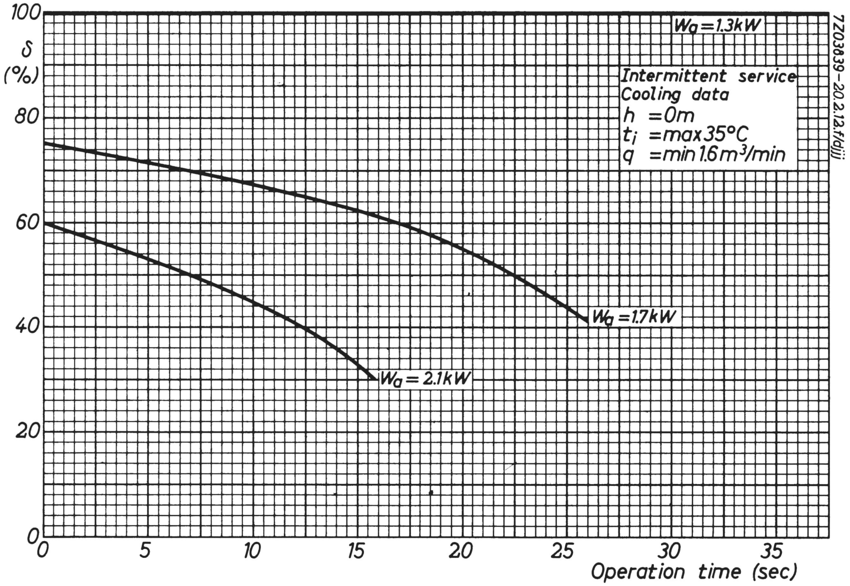
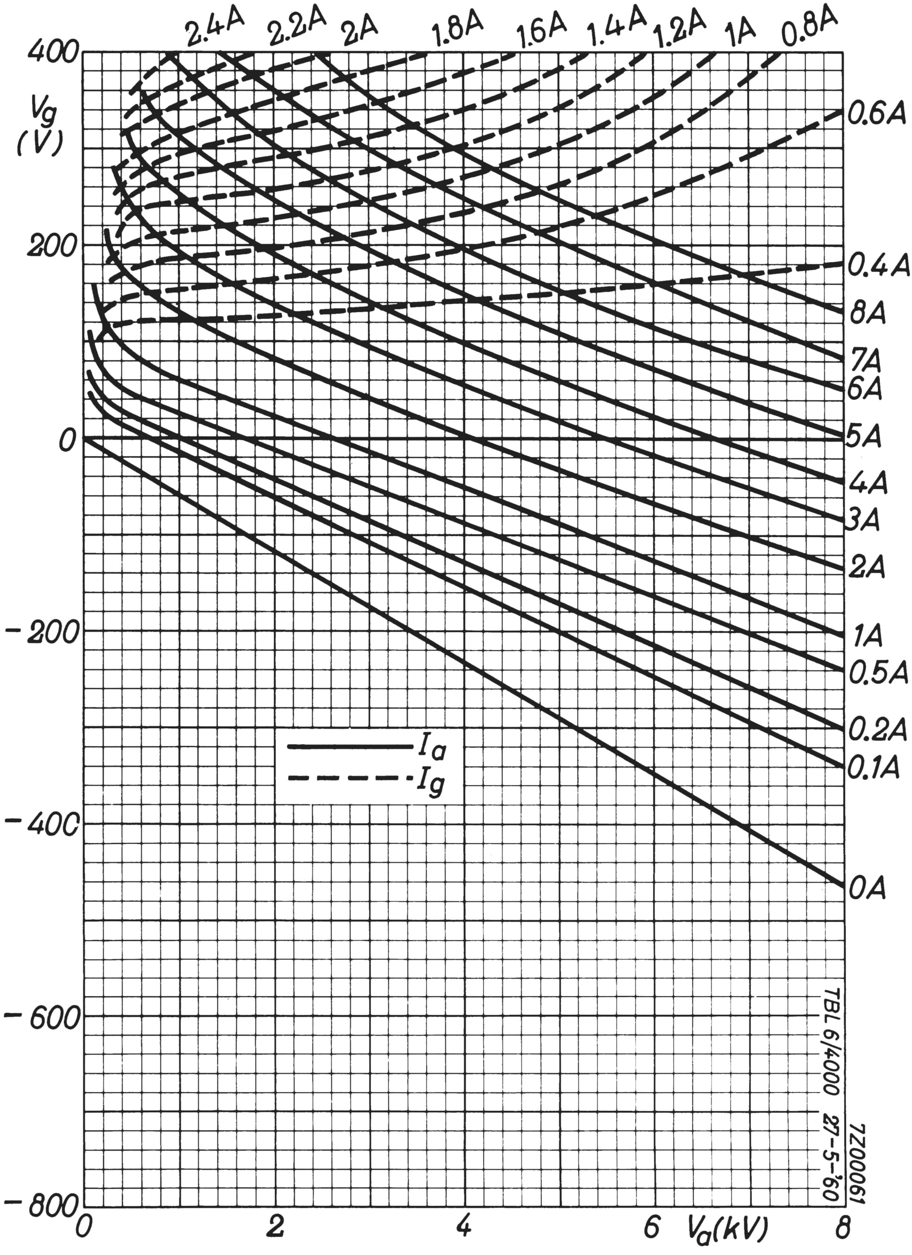
[1] See figure page A

[2] In a typical circuit

[3] Useful power in the load measured in a circuit having an efficiency of 85%.

7Z2 4051


100
δ
(%)
80
60
40
20
0
0
5
10
15
20
25
30
35
Operation time (sec)
$W_a = 1.3$ kW
$W_a = 1.7$ kW
$W_a = 2.1$ kW
Intermittent service
Cooling data
h = 0m
t_i = max 35°C
q = min 1.6 m^3/min
7Z03839-20.2.12.f/d/jj


2.4A
2.2A
2A
1.8A
1.6A
1.4A
1.2A
1A
0.8A
0.6A
0.4A
8A
7A
6A
5A
4A
3A
2A
1A
0.5A
0.2A
0.1A
0A
400
200
0
-200
-400
-600
-800
Vg (V)
0
2
4
6
8
Va(kV)
Ia
Ig
TBL 6/4000 27-5-'60
7Z00061

AIR COOLED R.F. POWER TRIODE

QUICK REFERENCE DATA

General purposes

λ (m)	Freq. (MHz)	C telegr.		B teleph.		C_a mod.		B mod. 1)	
		V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)
4	75	6	6.9	6	1.9			6	13.3
		5	5.6	5	1.45	5	4.7	5	6.6
		4	4			4.5	4.1	4.5	6.0
						4	3.5	4	5.3
						3.5	3	3.5	4.6
						3	2.2	3	3.3

Television service

Freq. (MHz)	Neg. mod. Pos. sync.			Pos. mod. Neg. sync.	
	V_a (kV)	W_o sync (kW)	W_o black (kW)	V_a (kV)	W_o white (kW)
75	5	9	5.35	5	9

HEATING: direct; filament thoriated tungsten

Filament voltage V_f = 12.6 V

Filament current I_f = 33 A

CAPACITANCES

Anode to all other elements except grid C_a = 0.3 pF

Grid to all other elements except anode C_g = 16 pF

Anode to grid C_{ag} = 11 pF

COOLING: forced air

---

1) Two tubes

7Z2 8658

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	4	kV
Anode current	I_a	=	1	A
Amplification factor	μ	=	32	
Mutual conductance	S	=	17	mA/V

AIR COOLING CHARACTERISTICS, see also the cooling curves

W_a (kW)	h (m)	t_i max. (°C)	$q_{min.}$ (m^3/min)	p_i (mm H_2O)
1	0	35	3	8
	0	45	3.1	8
	1500	35	3.7	9
	3000	25	4.1	10
3	0	35	5.2	23
	0	45	6.1	29
	1500	35	6.2	26
	3000	25	6.6	26
5	0	35	9.2	68
	0	45	10.7	90
	1500	35	11.2	81
	3000	25	11.6	79

MECHANICAL DATA

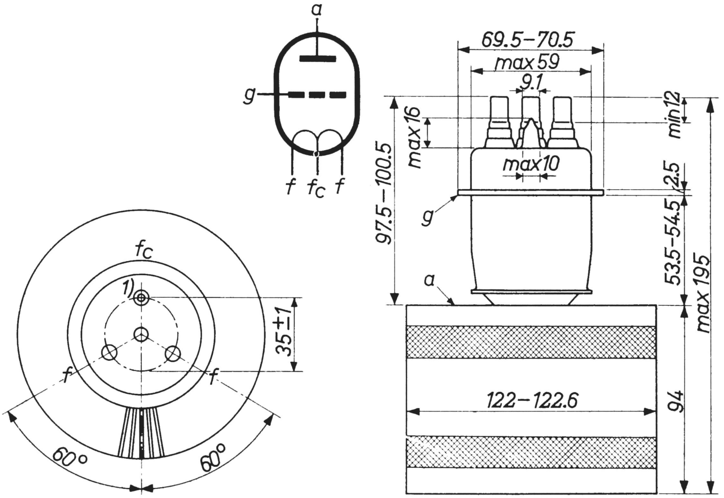
Dimensions in mm

Grid connector : 40650 [2]
or 40622

Filament connectors: 40634

Insulating pedestal : 40630

Tube net weight : 4.6 kg


a
g
f
f_c
f
f_c
1)
35±1
f
f
60°
60°
69.5–70.5
max 59
9.1
max 16
97.5–100.5
max 10
min 12
2.5
53.5–54.5
max 195
g
a
122–122.6
94

Mounting position: vertical with anode up or down

The centre tap f_c must not be used for filament current supply. The connectors type 40634, however, must be used for the cooling of all three filament pins, thus also of pin f_c

---

[1] This pin is marked "O"

[2] The connector 40650 should be used only below 30 MHz

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

Frequency	f		up to	75	MHz
Anode voltage	V_a	=	max.	6	kV
Negative grid voltage	$-V_g$	=	max.	1000	V
Anode current	I_a	=	max.	1.5	A
Grid current	I_g	=	max.	0.35	A
Grid dissipation	W_g	=	max.	120	W
Anode input power	W_{ia}	=	max.	9	kW
Anode dissipation	W_a	=	max.	5	kW

OPERATING CONDITIONS

Wavelength	λ	=	4	4	4	m
Frequency	f	=	75	75	75	MHz
Anode voltage	V_a	=	6	5	4	kV
Grid voltage	V_g	=	-400	-300	-200	V
Anode current	I_a	=	1.5	1.5	1.37	A
Grid current	I_g	=	0.31	0.33	0.35	A
Peak grid A.C. voltage	V_{gp}	=	740	640	500	V
Grid input power	W_{ig}	=	210	190	160	W
Anode input power	W_{ia}	=	9	7.5	5.5	kW
Anode dissipation	W_a	=	2.1	1.9	1.5	kW
Output power	W_o	=	6.9	5.6	4	kW
Efficiency	η	=	76.5	75	73	%

7Z2 8661

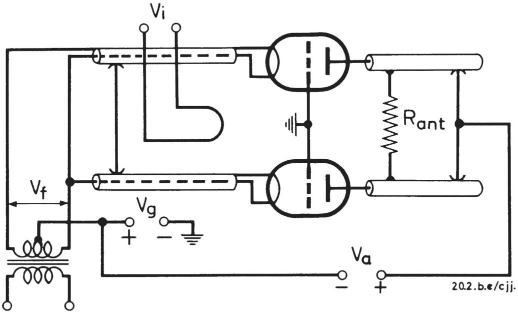
R.F. CLASS C TELEGRAPHY, grounded grid

LIMITING VALUES (Absolute limits)

Frequency	f		up to	75	MHz
Anode voltage	V_a	=	max.	6	kV
Positive cathode to grid voltage	V_{kg}	=	max.	1000	V
Anode current	I_a	=	max.	1.5	A
Grid current	I_g	=	max.	0.35	A
Grid dissipation	W_g	=	max.	120	W
Anode input power	W_{ia}	=	max.	9	kW
Anode dissipation	W_a	=	max.	5	kW

For frequencies from 75 MHz tap to 220 MHz See page C

OPERATING CONDITIONS, two tubes



For data please refer to page 6

R.F. CLASS C TELEGRAPHY, grounded grid (continued)

OPERATING CONDITIONS, two tubes (continued)

λ	=	4	2.7[1]	2.7[1]	1.36[1]	m	
f	=	75	110	110	220	MHz	
V_a	=	6	5	4	4	kV	
V_g	=	-400	-300	-200	-200	V	
I_a	=	2x1.5	2x1.5	2x1.37	2x1.25	A	
I_g	=	2x0.31	2x0.33	2x0.35	2x0.2	A	
V_{g_p}	=	740	640	500	450	V	
W_{ig}	=	2x1120	2x920	2x675	2x380	W	
W_{ia}	=	2x9	2x7.5	2x5.5	2x5	kW	
W_a	=	2x2.1	2x2.2	2x1.7	2x2.5	kW	
W_o	=	13.8+1.82	10.6+1.46	7.6+1.03	5+0.6	kW	[2]
η	=	76.5	71	69	50	%	[3]

---

[1] When using the tube above 108 MHz, particular attention must be paid to a careful design of the installation, otherwise the tube may be damaged. Therefore, our guarantee for the tubes operating at frequencies above 108 MHz can only be given after approval of the installation.

[2] Power transferred from driving stage included.

[3] Pure tube efficiency.

7Z2 8663

R.F. CLASS B TELEPHONY

LIMITING VALUES (Absolute limits)

Frequency	f	up to	75	MHz
Anode voltage	V_a	= max.	6	kV
Anode current	I_a	= max.	1.1	A
Anode input power	W_{ia}	= max.	6.6	kW
Anode dissipation	W_a	= max.	5	kW

OPERATING CONDITIONS

Wavelength	λ	=	4	4	m
Frequency	f	=	75	75	MHz
Anode voltage	V_a	=	6	5	kV
Grid voltage	V_g	=	-180	-145	V
Anode current	I_a	=	0.99	0.9	A
Peak grid A.C. voltage	V_{g_p}	=	250	225	V
Anode input power	W_{ia}	=	5.9	4.5	kW
Anode dissipation	W_a	=	4	3.05	kW
Output power	W_o	=	1.9	1.45	kW
Efficiency	η	=	32	32	%
Modulation factor	m	=	100	100	%
Grid current	I_g	=	0.3	0.32	A
Grid input power	W_{ig}	=	140	130	W

7Z2 8664

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

Frequency	f		up to	75	MHz
Anode voltage	V_a	=	max.	5	kV
Negative grid voltage	$-V_g$	=	max.	1000	V
Anode current	I_a	=	max.	1.3	A
Grid current	I_g	=	max.	0.35	A
Grid dissipation	W_g	=	max.	120	W
Anode input power	W_{ia}	=	max.	6.5	kW
Anode dissipation	W_a	=	max.	3.4	kW

OPERATING CONDITIONS

Wavelength	λ	=	4	4	4	4	4	m
Frequency	f	=	75	75	75	75	75	MHz
Anode voltage	V_a	=	5	4.5	4	3.5	3	kV
Grid voltage	V_g	=	-400	-350	-300	-300	-250	V [1]
Anode current	I_a	=	1.2	1.2	1.2	1.2	1	A
Grid current	I_g	=	0.3	0.3	0.3	0.3	0.3	A
Peak grid A.C. voltage	V_{g_p}	=	690	650	600	600	510	V
Grid input power	W_{ig}	=	190	180	165	165	140	W
Anode input power	W_{ia}	=	6	5.4	4.8	4.2	3	kW
Anode dissipation	W_a	=	1.3	1.3	1.3	1.2	0.8	kW
Output power	W_o	=	4.7	4.1	3.5	3.0	2.2	kW
Efficiency	η	=	78	76	73	71.5	73	%
Modulation fator	m	=	100	100	100	100	100	%
Modulation power	W_{mod}	=	3.0	2.7	2.4	2.1	1.5	kW

---

[1] Grid bias partially obtained by the grid resistor

A.F. CLASS B AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	=	max.	6	kV
Anode current	I_a	=	max.	1.5	A
Anode input power	W_{ia}	=	max.	9	kW
Anode dissipation	W_a	=	max.	5	kW
Grid circuit resistance	R_g	=	max.	15	kΩ

OPERATING CONDITIONS, two tubes

V_a	=	6		5		4.5		kV
V_g	=	−165		−138		−125		V
$R_{aa\sim}$	=	4900		6400		6100		Ω
V_{ggp}	=	0	910	0	661	0	655	V
I_a	=	2x0.125	2x1.5	2x0.11	2x0.91	2x0.1	2x0.92	A
I_g	=	0	2x0.28	0	2x0.14	0	2x0.09	A
W_{ig}	=	0	2x115	0	2x42	0	2x27	W
W_{ia}	=	2x0.75	2x9	2x0.55	2x4.55	2x0.45	2x4.15	kW
W_a	=	2x0.75	2x2.35	2x0.55	2x1.25	2x0.45	2x1.15	kW
W_o	=	0	13.3	0	6.6	0	6	kW
d_{tot}	=	-	4.3	-	3.3	-	3.7	%
η	=	-	74	-	73	-	72	%

V_a	=	4		3.5		3		kV
V_g	=	−112		−100		−90		V
$R_{aa\sim}$	=	4900		4200		4400		Ω
V_{ggp}	=	0	632	0	618	0	570	V
I_a	=	2x0.1	2x0.94	2x0.075	2x0.95	2x0.065	2x0.8	A
I_g	=	0	2x0.19	0	2x0.18	0	2x0.2	A
W_{ig}	=	0	2x54	0	2x50	0	2x52	W
W_{ia}	=	2x0.4	2x3.75	2x0.26	2x3.3	2x0.2	2x2.4	kW
W_a	=	2x0.4	2x1.1	2x0.26	2x1	2x0.2	2x0.75	kW
W_o	=	0	5.3	0	4.6	0	3.3	kW
d_{tot}	=	-	2.6	-	2.9	-	3.3	%
η	=	-	71	-	70	-	69	%

7Z2 3495

GRID MODULATED R.F. CLASS C AMPLIFIER for television service; negative modulation, positive synchronisation (American and European system)

LIMITING VALUES (Absolute limits)

Frequency	f			up to 75	up to 220	MHz
Anode voltage	V_a		=	max. 5	max. 4	kV
Anode input power	W_{ia}	sync	=	max. 9.5	max. 6.5	kW
Anode dissipation	W_a	sync	=	max. 5	max. 4	kW
Anode current	I_a	sync	=	max. 1.9	max. 1.6	A
Grid dissipation	W_g	sync	=	max. 120	max. 120	W
Negative grid voltage	$-V_g$		=	max. 1000	max. 1000	V

OPERATING CONDITIONS, two tubes in push-pull

Frequency	f		=	48 to 75	170 to 220 1)	MHz
Bandwidth (-1.5 db)	B		=	5.25	6.5	MHz 2)
Bandwidth (-3 db)	B		=	8	10	MHz 2)
Anode voltage	V_a		=	5	4	kV
Grid voltage	V_g	sync	=	-200	-150	V
		black	=	-300	-225	V
		white	=	-550	-500	V
Peak grid to grid voltage	V_{gg_p}	sync	=	1000	1000	V 3)
Anode current	I_a	sync	=	3.8	3.2	A
		black	=	2.8	2.6	A
Grid current	I_g	sync	=	0.5	0.4	A
		black	=	0.35	0.22	A
Grid input power	W_{ig}	sync	=	250	350 to 450	W 4)
Output power	W_o	sync	=	9	6	kW
		black	=	5.35	3.37	kW

---

1) When using the tube above 108 MHz, particular attention must be paid to a careful design of the installation, otherwise the tube may be damaged. Therefore, our guarantee for the tubes operating at frequencies above 108 MHz can only be given after approval of the installation

2) These values are based on measurements on a circuit with a single LC section

3) Measured by the slide back method

4) Driving power is accounted for largely by circuit losses. The indicated driving power is required to take care of losses in damping resistors, circuit losses and tube driving power

7Z2 8666

GRID MODULATED R.F. CLASS C AMPLIFIER for television service; positive modulation, negative synchronisation (BBC system)

LIMITING VALUES (Absolute limits)

Frequency	f		up to	75	MHz
Anode voltage	V_a		= max.	5	kV
Negative grid voltage	$-V_g$		= max.	1000	V
Anode current	I_a	white	= max.	1.9	A
Anode input power	W_{ia}	white	= max.	9.5	kW
Anode dissipation	W_a	white	= max.	5	kW
Grid dissipation	W_g	white	= max.	120	W

OPERATING CONDITIONS, two tubes in push-pull

Frequency	f		=	48-75	MHz
Bandwidth (I_{ant} = 85 %)	B		=	5.25	MHz
Bandwidth (I_{ant} = 70 %)			=	8	MHz
Anode voltage	V_a		=	5	kV
Grid voltage	V_g	white	=	-200	V
		black	=	-460	V
		sync	=	-580	V
Peak grid to grid voltage	V_{ggp}	white	=	1000	V
Anode current	I_a	white	=	3.8	A
		black	=	0.8	A
Grid current	I_g	white	=	0.5	A
		black	=	0	A
Grid input power	W_{ig}	white	=	250	W
Output power	W_o	white	=	9	kW
		black	=	0.6	kW

7Z2 8667

R.F. CLASS B TELEPHONY for television service (American and European system

LIMITING VALUES (Absolute limits)

Frequency	f			up to 75	up to 220	MHz
Anode voltage	V_a		=	max. 5	max. 4	kV
Anode input power	W_{ia}	sync	=	max. 9.5	max. 6.5	kW
Anode dissipation	W_a	sync	=	max. 5	max. 4	kW
Anode current	I_a	sync	=	max. 1.9	max. 1.6	A
Grid dissipation	W_g	sync	=	max. 120	max. 120	W

OPERATING CONDITIONS, two tubes in push-pull

Frequency	f		=	48 to 75	170 to 220 1)	MHz
Bandwidth (-1.5 db)	B		=	5.25	6.5	MHz 2)
Bandwidth (-3 db)	B		=	8	10	MHz 2)
Anode voltage	V_a		=	5	4	kV
Grid voltage	V_g		=	-200	-150	V
Peak grid to grid voltage	V_{ggp}	sync	=	1000	1000	V 3)
		black	=	800	750	V 3)
		white	=	0	200	V 3)
Anode current	I_a	sync	=	3.8	3.2	A
		black	=	3	2.6	A
		white	=	0.2	-	A
Grid current	I_g	sync	=	0.5	0.4	A
		black	=	0.22	0.22	A
		white	=	0	-	A
Grid input power	W_{ig}	sync	=	250	350 to 450	W 4)
Output power	W_o	sync	=	9	6	kW
		black	=	5.35	3.37	kW

---

1) When using the tube above 108 MHz, particular attention must be paid to a careful design of the installation, otherwise the tube may be damaged Therefore, our guarantee for the tubes operating at frequencies above 108 MHz can only be given after approval of the installation

2) These values are based on measurements on a circuit with a single LC section

3) Measured by the slide back method

4) Driving power is accounted for largely by circuit losses. The indicated driving power is required to take care of losses in damping resistors, circuit losses and tube driving power

7Z2 8668

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from two-phase half-wave rectifier without filter

LIMITING VALUES (Absolute limits)

Frequency	f	up to	75	MHz
Anode voltage	V_a	= max.	5400	V
Negative grid voltage	$-V_g$	= max.	900	V
Anode current	I_a	= max.	1.35	A
Grid current	I_g	= max.	0.31	A
Anode input power	W_{ia}	= max.	9	kW
Anode dissipation	W_a	= max.	5	kW
Grid dissipation	W_g	= max.	120	W

OPERATING CONDITIONS

Transformer voltage	V_{tr}	=	6.0 1)	5.1 2)	kV_{RMS}
Anode voltage	V_a	=	5.4	4.6	kV 3)
Anode current	I_a	=	1.35	1.15	A
Grid current	I_g	=	0.31	0.27	A
Grid resistor	R_g	=	1300	1100	Ω
Grid input power	W_{ig}	=	210	160	W
Anode input power	W_{ia}	=	9	6.5	kW
Anode dissipation	W_a	=	2.3	1.84	kW
Output power	W_o	=	6.5	4.5	kW
Efficiency	η	=	72	70	%

---

1) Care must be taken that under these operating conditions the absolute limiting values are not exceeded by variation of the supply voltage or the load or by tolerances in the circuit elements

2) Under these conditions normal deviations of voltages and load are permissible. The absolute limiting values of the tube must, however, not be exceeded

3) D.C. value

7Z2 8669

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from three-phase half-wave rectifier without filter

LIMITING VALUES (Absolute limits)

Frequency	f		up to	75	MHz
Anode voltage	V_a	=	max.	6000	V
Negative grid voltage	$-V_g$	=	max.	1000	V
Anode current	I_a	=	max.	1.5	A
Grid current	I_g	=	max.	0.35	A
Anode input power	W_{ia}	=	max.	9	kW
Anode dissipation	W_a	=	max.	5	kW
Grid dissipation	W_g	=	max.	120	W

OPERATING CONDITIONS

Frequency	f	=	75	75	MHz
Transformer voltage	V_{tr}	=	5.1[1]	4.4[2]	kV_{RMS}
Anode voltage	V_a	=	6.0	5.1	kV[3]
Anode current	I_a	=	1.5	1.25	A
Grid current	I_g	=	0.31	0.28	A
Grid resistor	R_g	=	1300	1100	Ω
Grid input power	W_{ig}	=	210	160	W
Anode input power	W_{ia}	=	9	6.4	kW
Anode dissipation	W_a	=	1.9	1.74	kW
Output power	W_o	=	6.9	4.5	kW
Efficiency	η	=	76.5	70	%

---

[1] Care must be taken that under these operating conditions the absolute limiting values are not exceeded by variation of the supply voltage or the load or by tolerances in the circuit elements

[2] Under these conditions normal deviations of voltages and load are permissible. The absolute limiting values of the tube must, however, not be exceeded

[3] D.C. value

7Z2 8670

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with self rectification

LIMITING VALUES (Absolute limits)

Frequency	f		up to	75	MHz
Transformer voltage	V_{tr}	=	max.	6800	V_{RMS}
Negative grid voltage	$-V_g$	=	max.	640	V
Anode current	I_a	=	max.	0.8	A
Grid current	I_g	=	max.	0.19	A
Anode input power	W_{ia}	=	max.	9	kW
Anode dissipation	W_a	=	max.	5	kW
Grid dissipation	W_g	=	max.	120	W

OPERATING CONDITIONS

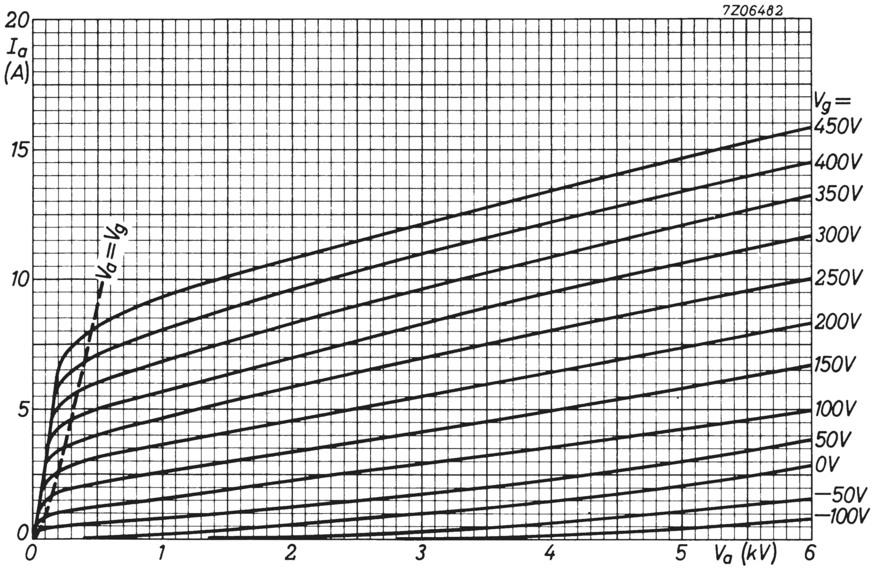
Frequency	f	=	75	75	MHz
Transformer voltage	V_{tr}	=	6.8[1]	5.9[2]	kV_{RMS}
Anode current	I_a	=	0.8	0.7	A
Grid current	I_g	=	0.19	0.165	A
Grid resistor	R_g	=	1050	1050	Ω
Grid input power	W_{ig}	=			W
Anode input power	W_{ia}	=	6.05	4.6	kW
Anode dissipation	W_a	=	1.5	1.24	kW
Output power	W_o	=	4.55	3.36	kW
Efficiency	η	=	75	73	%

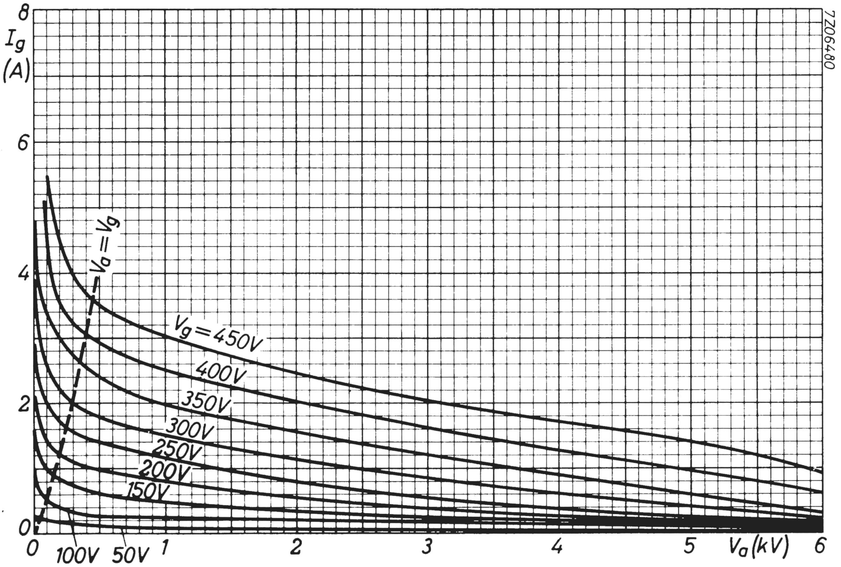
---

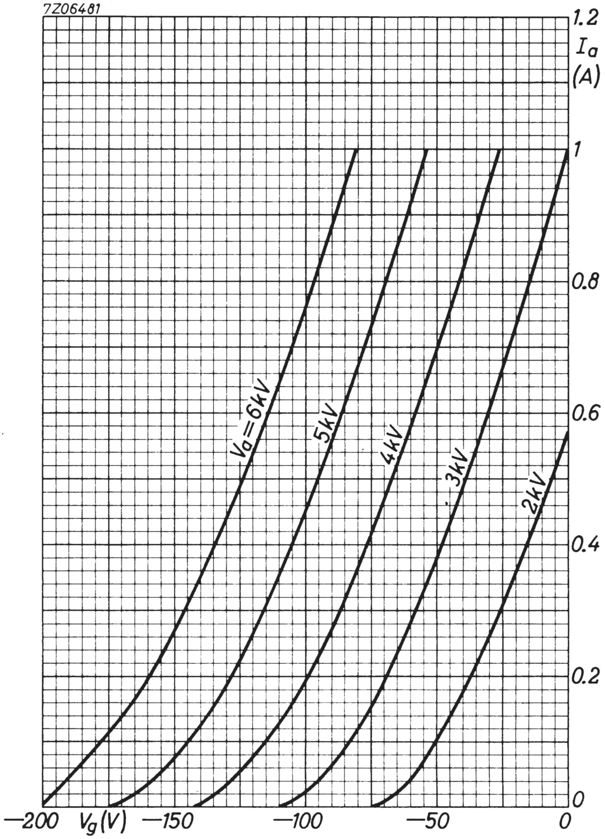
1) Care must be taken that under these operating conditions the absolute limiting values are not exceeded by variation of the supply voltage or the load or by tolerances in the circuit elements

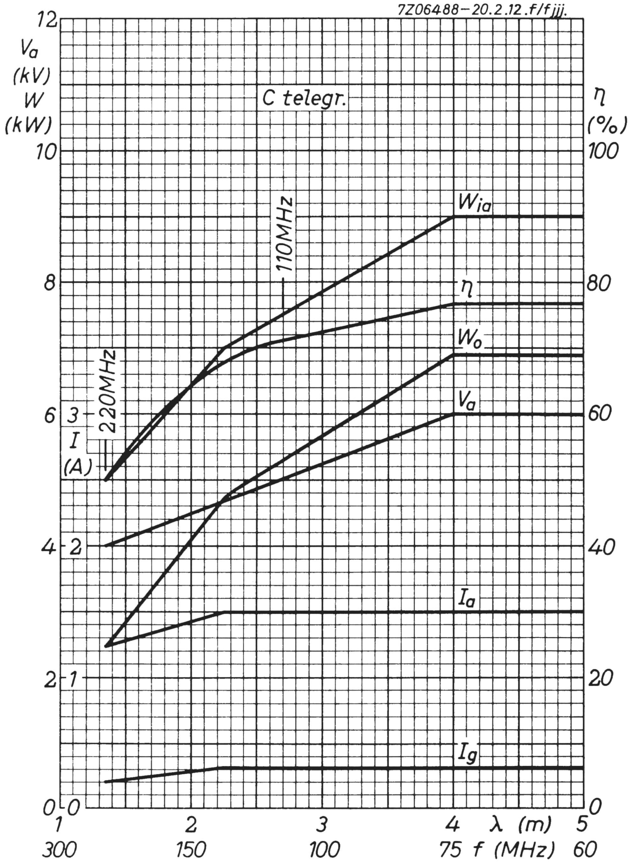
2) Under these conditions normal deviations of voltages and load are permissible. The absolute limiting values of the tube must, however, not be exceeded

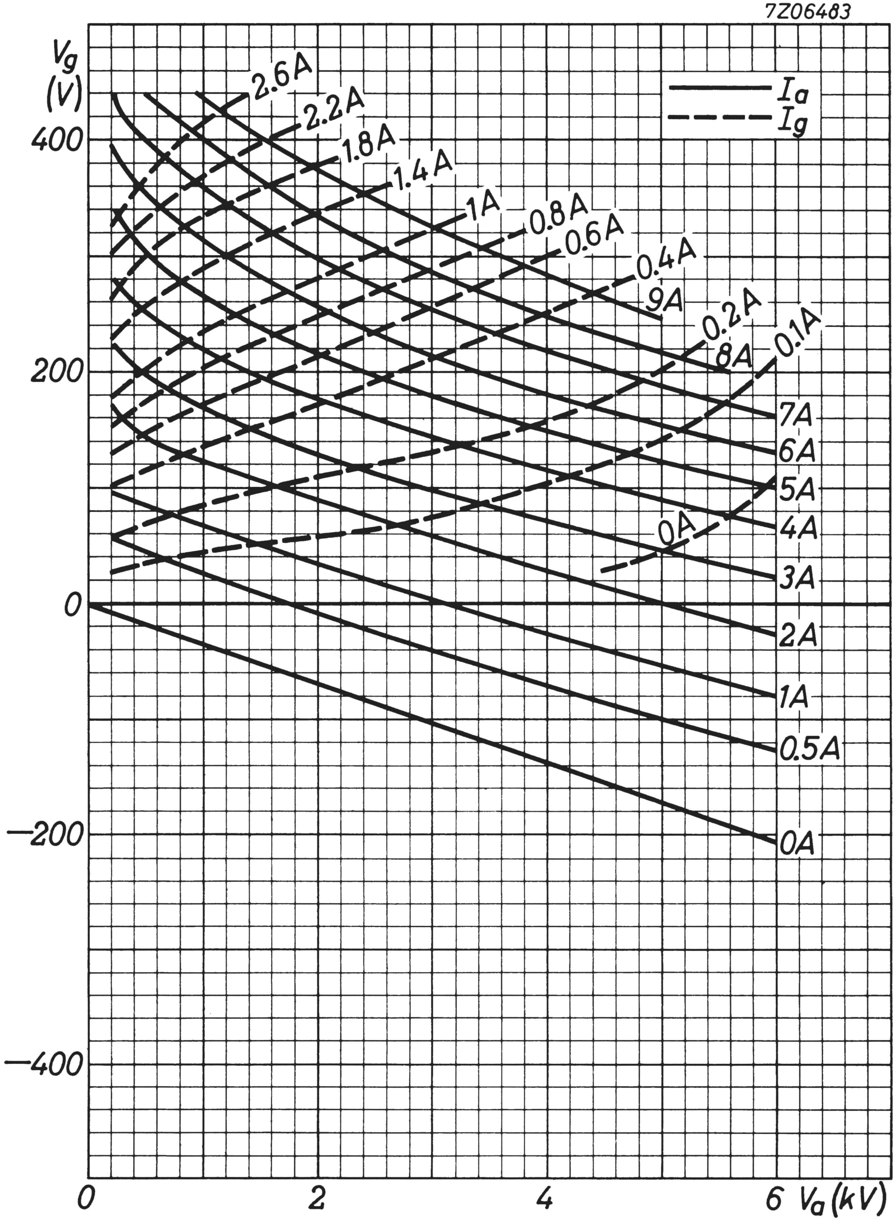
7Z2 8671

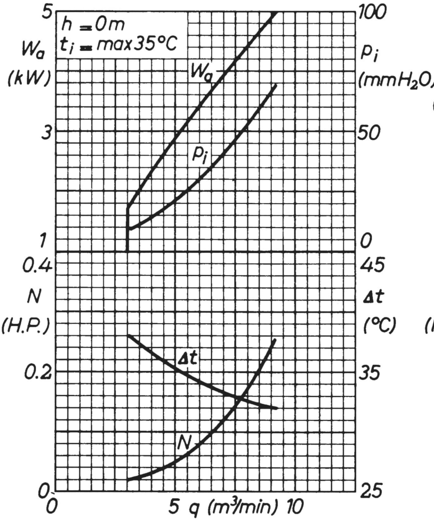

7Z06482
20
I_a
(A)
15
10
5
0
$V_a = V_g$
$V_g =$
450V
400V
350V
300V
250V
200V
150V
100V
50V
0V
−50V
−100V
0
1
2
3
4
5
V_a (kV)
6

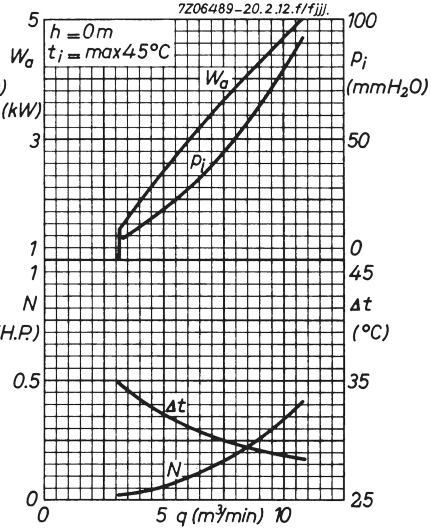

8
I_g
(A)
6
4
2
0
7Z06480
$V_a = V_g$
$V_g = 450V$
400V
350V
300V
250V
200V
150V
100V
50V
0
1
2
3
4
5
V_a (kV)
6


7Z06481
1.2
I_a
(A)
1
0.8
0.6
0.4
0.2
0
V_a=6kV
5kV
4kV
3kV
2kV
—200
V_g(V)
—150
—100
—50
0


7Z06488–20.2.12.f/fjjj.
12
V_a
(kV)
W
(kW)
10
8
6
4
2
0
3
I
(A)
2
1
0
η
(%)
100
80
60
40
20
0
C telegr.
110MHz
220MHz
W_{ia}
η
W_o
V_a
I_a
I_g
1
2
3
4
5
λ (m)
300
150
100
75
60
f (MHz)


7Z06483
Vg (V)
400
200
0
−200
−400
0
2
4
6 Va (kV)
Ia
Ig
2.6A
2.2A
1.8A
1.4A
1A
0.8A
0.6A
0.4A
0.2A
0.1A
0A
9A
8A
7A
6A
5A
4A
3A
2A
1A
0.5A
0A





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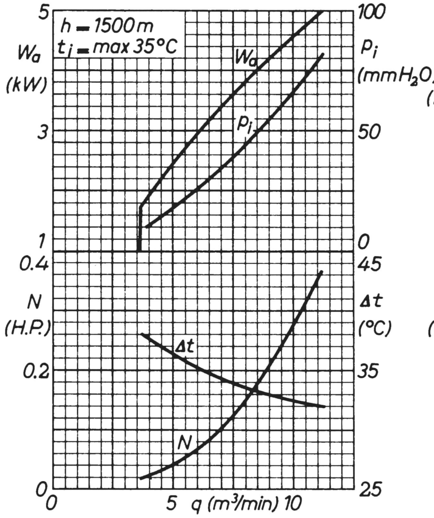
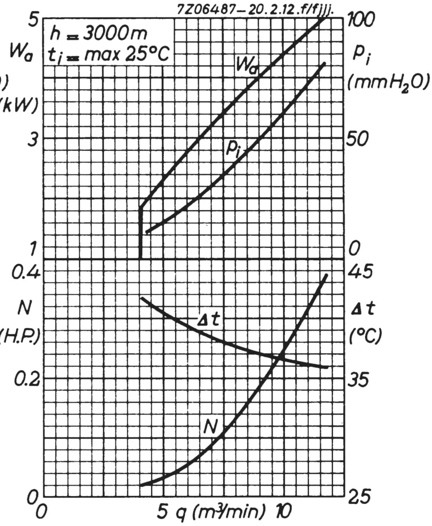




7Z06487-20.2.12.f/fjjj.

AIR COOLED R.F. POWER TRIODE

Triode for use in industrial R.F. generators and in telegraphy and telephony transmitters.

QUICK REFERENCE DATA

λ	Freq.	C telegr.		C osc.		B mod. [1]	
(m)	(MHz)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)
10	30	6.5	9.5			7.0	20
		6.0	8.5			5.0	9.0
		5.0	7.1			4.0	7.1
6	50			6.0	6.0		

COOLING : forced air

HEATING : direct; filament thoriated tungsten

Filament voltage	V_f	=	12.6	V
Filament current	I_f	=	33	A

CAPACITANCES

Anode to all other elements except grid	C_a	=	0.3	pF
Grid to all other elements except anode	C_g	=	16	pF
Anode to grid	C_{ag}	=	11	pF

TYPICAL CHARACTERISTICS

Anode current	I_a	=	1	A
Anode voltage	V_a	=	6	kV
Amplification factor	μ	=	32	
Mutual conductance	S	=	15	mA/V

---

[1] Two tubes

AIR COOLING CHARACTERISTICS

W_a	h	t_i max.	q min.	p_i
(kW)	(m)	(^oC)	(m^3/min)	(mm H_2O)
2	0	35	4.8	20
	0	45	5.7	25
	1500	35	5.7	23
	3000	25	6.1	23
3.5	0	35	6.2	32
	0	45	7.3	42
	1500	35	7.3	36
	3000	25	7.8	36
6	0	35	9.2	68
	0	45	10.7	91
	1500	35	11.2	81
	3000	25	11.7	80

See cooling curves

Temperature of filament seals = max. 210 ^oC

Temperature of grid and anode seals = max. 180 ^oC

Filament connectors 40634

Connector for centre pin of filament 40649 [1]

Grid connector 40650 [2] or 40622

Insulating pedestal (see page 4) 40630

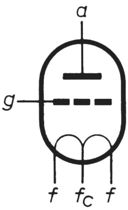
---

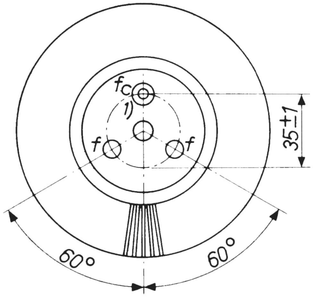
[1] The centre tap f_c (diameter 10.5 mm; marked O) must not be used for filament current supply. The connector type 40649, however, must be used for the cooling of this pin.

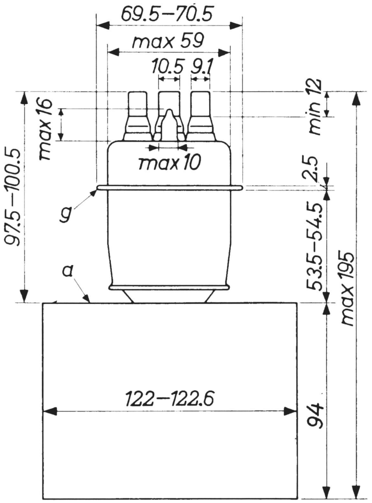
[2] See page 4. The connector 40650 should only be used below 30 MHz .

MECHANICAL DATA

Dimensions in mm




f_c
1)
f
f
35±1
60°
60°


69.5–70.5
max 59
10.5
9.1
min 12
max 16
max 10
2.5
97.5–100.5
g
a
53.5–54.5
max 195
122–122.6
94

Mounting position: vertical with anode up or down.

---

[1] See page 2

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

Frequency	f		up to	30	MHz
Anode voltage	V_a	=	max.	7.2	kV
Negative grid voltage	$-V_g$	=	max.	1250	V
Anode current	I_a	=	max.	2.2	A
Grid current	I_g	=	max.	0.6	A
Anode input power	W_{ia}	=	max.	14	kW
Anode dissipation	W_a	=	max.	6	kW

OPERATING CONDITIONS

Wavelength	λ	=	10	10	10	m
Frequency	f	=	30	30	30	MHz
Anode voltage	V_a	=	6.5	6.0	5.0	kV
Grid voltage	V_g	=	-450	-400	-300	V
Anode current	I_a	=	2.0	2.0	2.0	A
Grid current	I_g	=	0.5	0.5	0.5	A
Peak grid A.C. voltage	V_{g_p}	=	820	780	660	V
Grid input power	W_{ig}	=	370	350	297	W
Anode input power	W_{ia}	=	13	12	10	kW
Anode dissipation	W_a	=	3.5	3.5	2.9	kW
Output power	W_o	=	9.5	8.5	7.1	kW
Efficiency	η	=	73	71	71	%

A.F. CLASS B AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	= max.	7.2	kV
Anode current	I_a	= max.	2.2	A
Anode input power	W_{ia}	= max.	14	kW
Anode dissipation	W_a	= max.	6	kW
Grid circuit resistance	R_g	= max.	15	kΩ

OPERATING CONDITIONS, two tubes

V_a =	7		5		5		4		kV
V_g =	-250		-165		-165		-135		V
$R_{aa\sim}$ =	4150		4800		5500		3800		Ω
V_{ggp} =	0	1300	0	880	0	730	0	930	V
I_a =	2x0.2	2x2.0	2x0.15	2x1.25	2x0.15	2x1.1	2x0.1	2x1.25	A
I_g =	0	2x0.53	0	2x0.33	0	2x0.22	0	2x0.36	A
I_{gp} =	-	2x2.8	-	2x1.75	-	2x1.2	-	2x1.8	A
W_{ig} =	0	2x310	0	2x130	0	2x70	0	2x135	W
W_{ia} =	2x1.4	2x14	2x0.75	2x6.2	2x0.75	2x5.5	2x0.4	2x5.0	kW
W_a =	2x1.4	2x4.0	2x0.75	2x1.7	2x0.75	2x1.5	2x0.4	2x1.45	kW
W_o =	0	20	0	9	0	8.0	0	7.1	kW
η =	-	71.5	-	72.5	-	72.5	-	71	%

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from three-phase half-wave rectifier without filter

LIMITING VALUES (Absolute limits)

Frequency	f		up to	55	MHz
Anode voltage	V_a	=	max.	7	kV
Negative grid voltage	$-V_g$	=	max.	1250	V
Anode current	I_a	=	max.	1.8	A
Grid current	I_g	=	max.	0.5	A [1]
Anode input power	W_{ia}	=	max.	11	kW
Anode dissipation	W_a	=	max.	6	kW
Grid circuit resistance	R_g	=	max.	10	kΩ

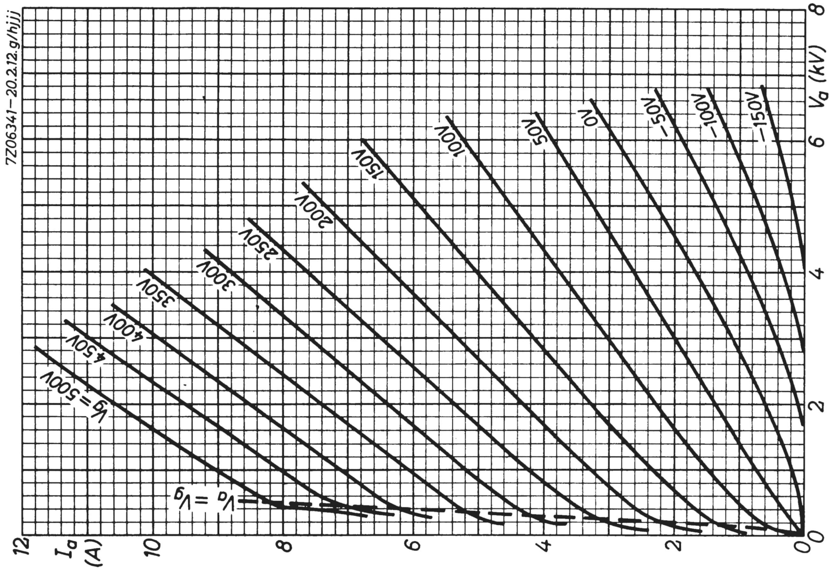
OPERATING CONDITIONS

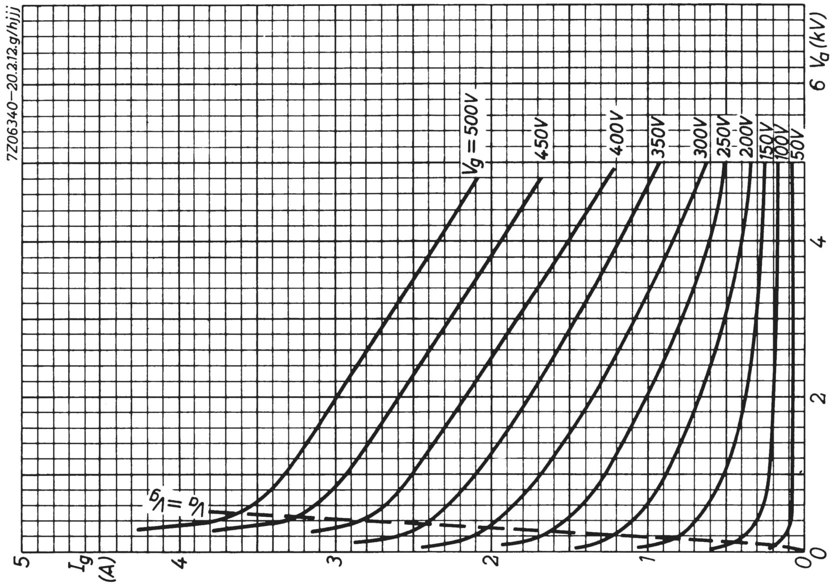
Frequency	f	=	50	MHz
Transformer voltage	V_{tr}	=	5100	V_{RMS}
Anode voltage	V_a	=	6.0	kV
Anode current	I_a	=	1.5	A
Grid current	I_g	=	0.4	A [1]
Grid resistor	R_g	=	1000	Ω
Grid input power	W_{ig}	=	300	W
Anode input power	W_{ia}	=	9	kW
Anode dissipation	W_a	=	2.7	kW
Output power	W_o	=	6	kW [2]
Efficiency	η	=	67	%

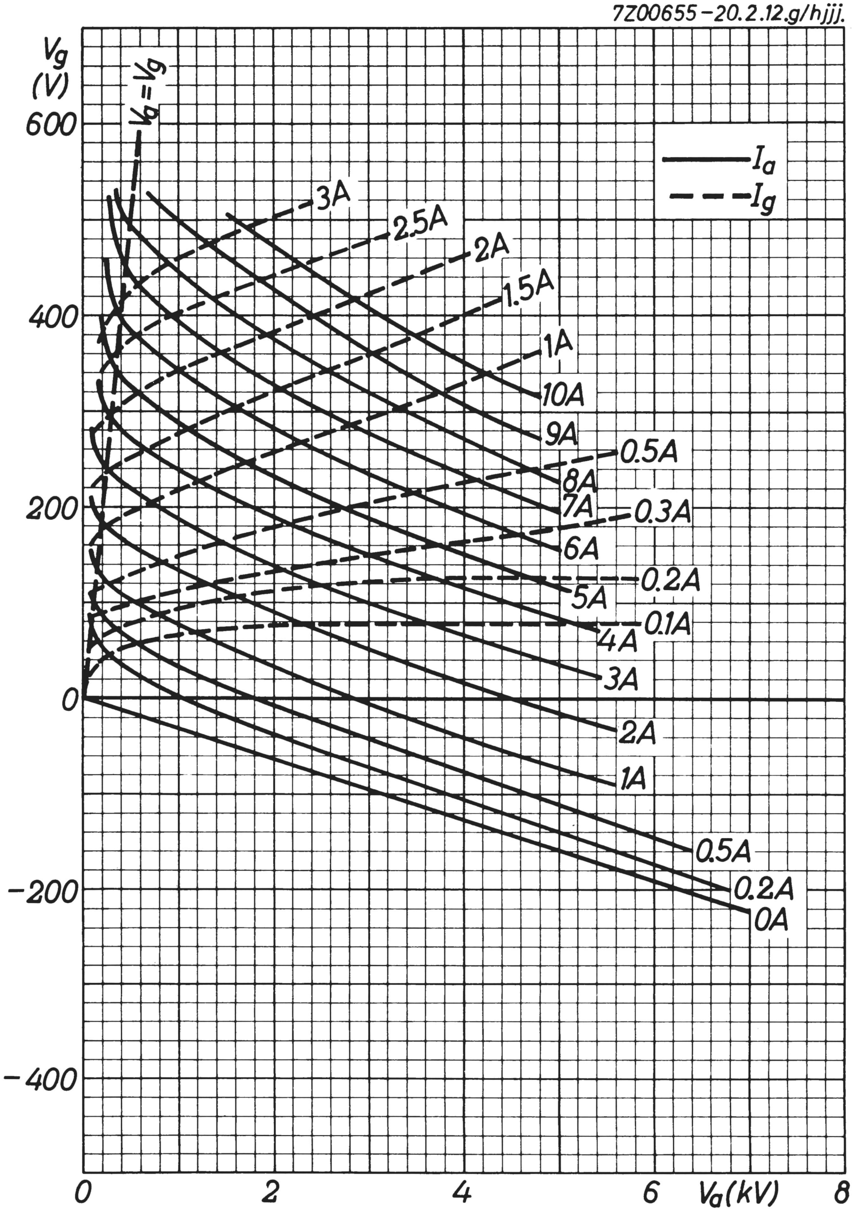
---

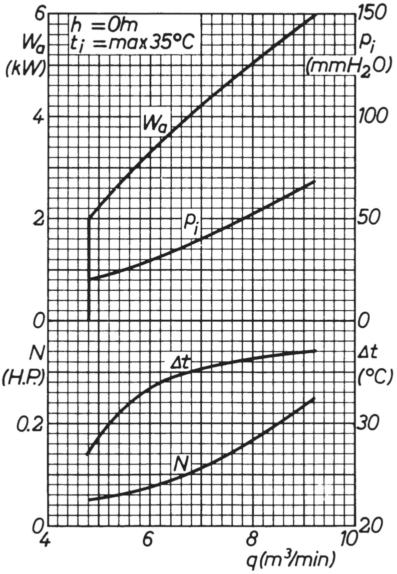
[1] Unloaded 0.7 A

[2] Available power (load + circuit losses)

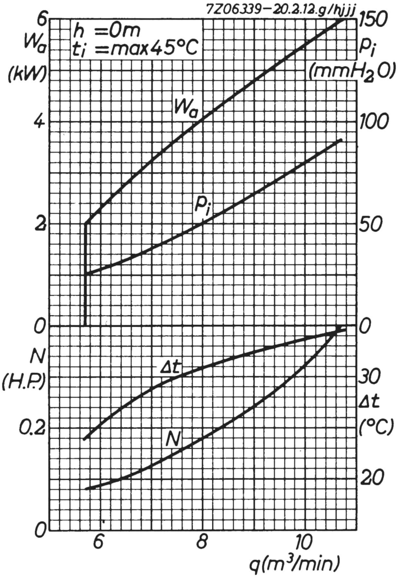

7Z06341–20.2.12.g/hjjj
I_a (A)
12
10
8
6
4
2
0
V_a (kV)
0
2
4
6
8
V_g = 500V
450V
400V
350V
300V
250V
200V
150V
100V
50V
0V
−50V
−100V
−150V
$V_a = V_g$

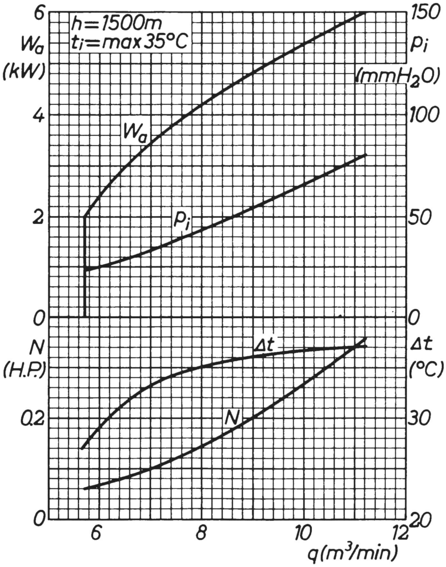

7Z06340–20.2.12.g/hjjj
I_g (A)
5
4
3
2
1
0
V_a (kV)
0
2
4
6
V_g = 500V
450V
400V
350V
300V
250V
200V
150V
100V
50V
$V_a = V_g$


7Z00655 −20.2.12.g/hjjj.
Vg (V)
600
400
200
0
−200
−400
Va=Vg
Ia
Ig
3A
2.5A
2A
1.5A
1A
0.5A
0.3A
0.2A
0.1A
10A
9A
8A
7A
6A
5A
4A
3A
2A
1A
0.5A
0.2A
0A
0
2
4
6
8
Va(kV)

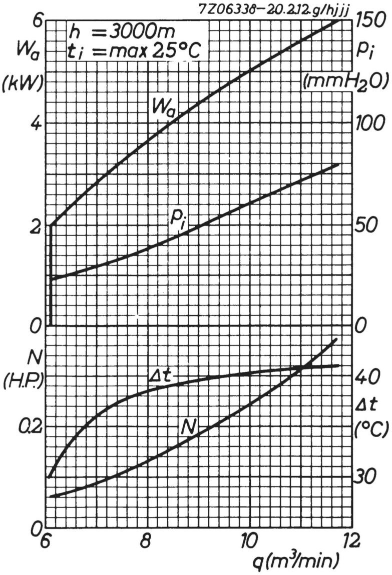


7Z06339-20.2.12.g/hjjj





7Z06338-20.2.12.g/hjjj



AIR COOLED
INDUSTRIAL R.F. POWER TRIODE

QUICK REFERENCE DATA		
Industrial R.F. oscillator class C		
Freq.	Three phase	
(MHz)	V_a (kV)	W_ℓ [1] (kW)
50	7.2 6.2	6.1 5.0

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	12.6	V	+5 % -10 %
Filament current	I_f	=	32	A	

CAPACITANCES

Anode to all other elements except grid	C_a	=	0.4	pF
Grid to all other elements except anode	C_g	=	13.5	pF
Anode to grid	C_{ag}	=	7.4	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	6	kV
Anode current	I_a	=	1	A
Mutual conductance	S	=	12	mA/V
Amplification factor	μ	=	24	

---

[1]) Useful power in the load

TEMPERATURE LIMITS (Absolute limits)

Temperature of anode and seals = max. 220 °C

AIR COOLING CHARACTERISTICS for continuous service

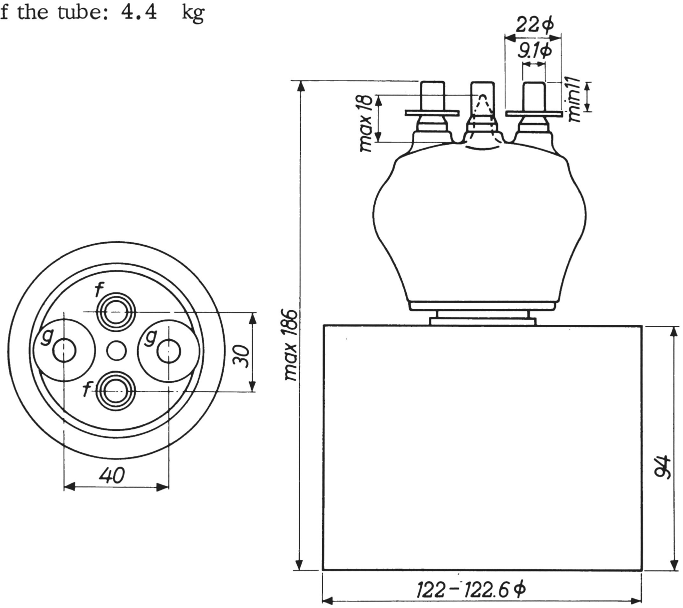
For intermittent service see figure page A

W_a (kW)	h (m)	t_i (°C)	q_{min} (m^3/min)	p_i (mm H_2O)
2	0	35	4.8	20
	0	45	5.7	25
	1500	35	5.7	23
	3000	25	6.1	23
4	0	35	6.8	38
	0	45	7.9	49
	1500	35	7.8	42
	3000	25	8.4	42
6	0	35	9.2	68
	0	45	10.7	90
	1500	35	11.2	81
	3000	25	11.7	81

At frequencies above 4 MHz both grid terminals should be connected in parallel. At the highest frequencies care should be taken to distribute the R.F. current equally over both grid terminals to avoid excessive grid seal temperatures.

MECHANICAL DATA Dimensions in mm

Net weight of the tube: 4.4 kg


22ϕ
9.1ϕ
min11
max 18
max 186
f
g
g
f
30
40
94
122 - 122.6 ϕ

Connectors for grid and filament	40634
Insulating pedestal	40630

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from three-phase rectifier without filter

LIMITING VALUES (Absolute limits), continuous service

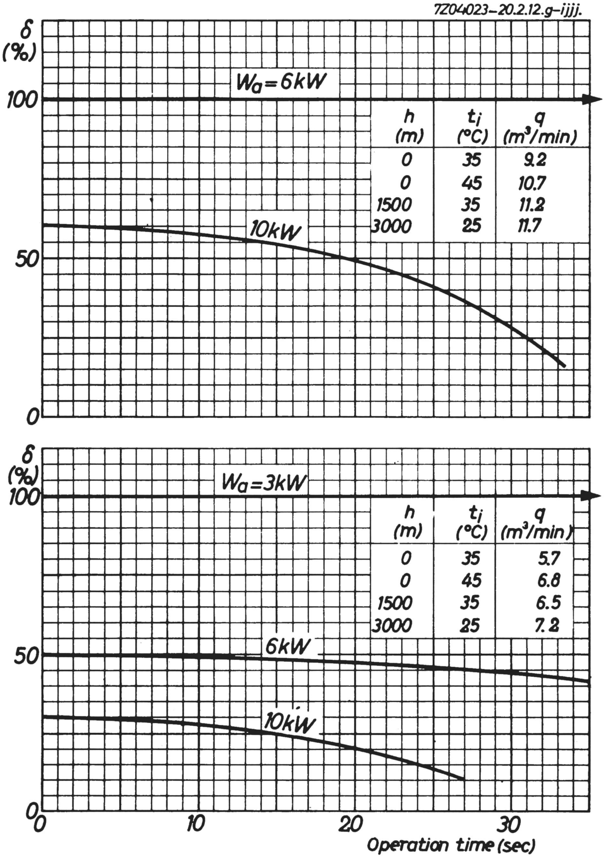
Frequency	f		up to	50	MHz
Anode voltage	V_a	=	max.	8	kV
Anode input power	W_{ia}	=	max.	12	kW
Anode dissipation	W_a	=	max.	6	kW
Anode current	I_a	=	max.	1.8	A
Negative grid voltage	$-V_g$	=	max.	1250	V
Grid current, loaded	I_g	=	max.	0.4	A
Grid current, unloaded	I_g	=	max.	0.5	A
Grid circuit resistance	R_g	=	max.	10	kΩ

OPERATING CHARACTERISTICS, continuous service

Frequency	f	=	50	50	MHz
Anode voltage	V_a	=	7200	6200	V
Anode current, loaded	I_a	=	1.5	1.4	A
Anode current, unloaded	I_a	=	0.37	0.40	A
Grid current, loaded	I_g	=	0.36	0.37	A
Grid current, unloaded	I_g	=	0.47	0.47	A
Grid resistor	R_g	=	1850	1500	Ω
Load resistance	$R_{a\sim}$	=	2300	2100	Ω
Feedback ratio under loaded conditions	$V_{g\sim}/V_{a\sim}$	=	17	17	%
Anode input power	W_{ia}	=	10.8	8.68	kW
Anode dissipation	W_a	=	3.3	2.5	kW
Efficiency	η	=	70	71	%
Output power in the load	W_{ℓ}	=	6.1	5.0	kW 1)

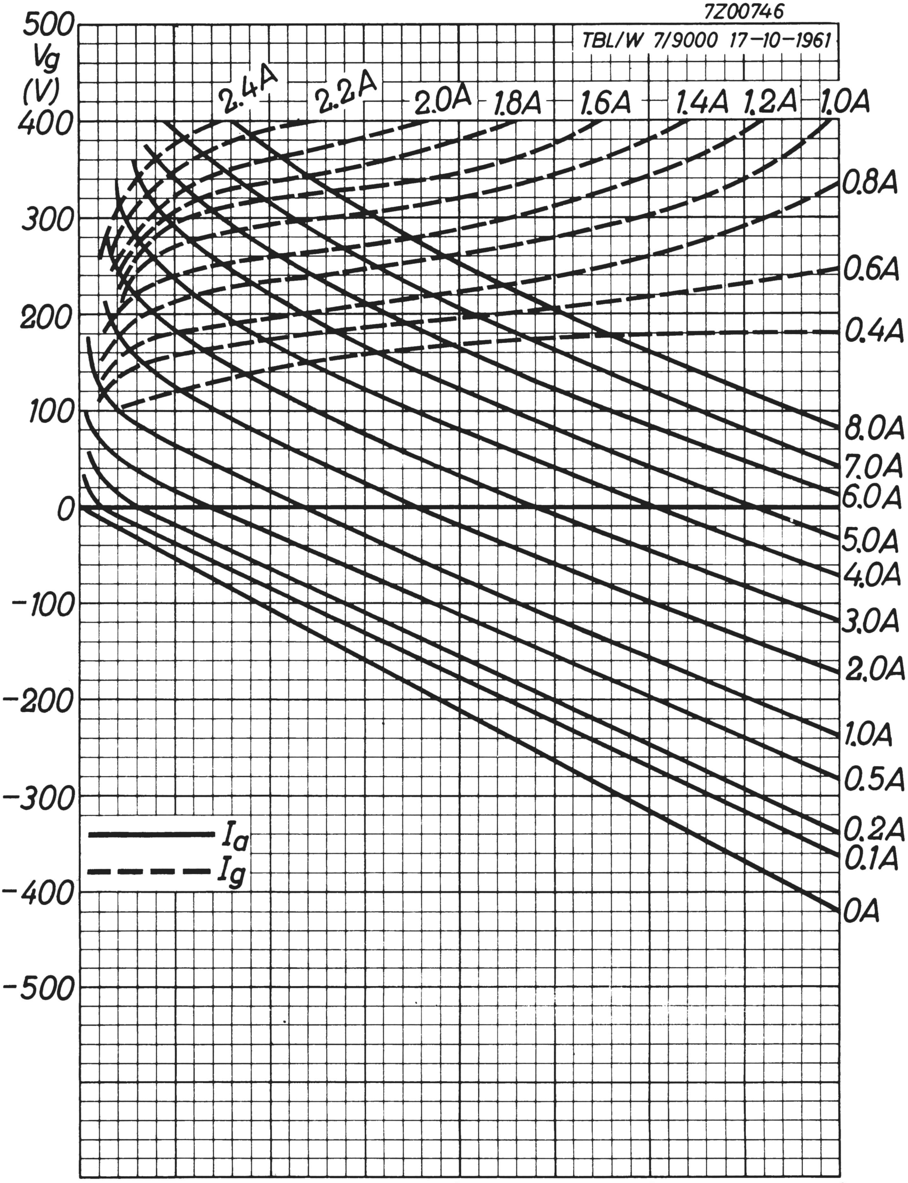
---

1) Useful power in the load, measured in a circuit having an efficiency of 85 %



h (m)	t_i (°C)	q (m^3/min)
0	35	9.2
0	45	10.7
1500	35	11.2
3000	25	11.7

h (m)	t_i (°C)	q (m^3/min)
0	35	5.7
0	45	6.8
1500	35	6.5
3000	25	7.2


7Z00746
TBL/W 7/9000 17-10-1961
500
Vg
(V)
400
300
200
100
0
-100
-200
-300
-400
-500
0
2
4
6
Va(kV)
8
2.4A
2.2A
2.0A
1.8A
1.6A
1.4A
1.2A
1.0A
0.8A
0.6A
0.4A
8.0A
7.0A
6.0A
5.0A
4.0A
3.0A
2.0A
1.0A
0.5A
0.2A
0.1A
0A
Ia
Ig

AIR COOLED
INDUSTRIAL R.F. POWER TRIODE

QUICK REFERENCE DATA		
Industrial R.F. oscillator class C		
Freq. (MHz)	three phase	
	V_a (kV)	W_o (kW)
30	12	29.0
	10	23.3
	8	17.9

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	8.0	V	+ 5 % -10 %
Filament current	I_f	=	98	A	
Cold filament resistance	R_{fo}	=	0.008	Ω	

The filament current must never exceed a peak value of 210 A instantaneously at any time during the initial energizing schedule

CAPACITANCES

Anode to all other elements except grid	C_a	=	0.4	pF
Grid to all other elements except anode	C_g	=	37	pF
Anode to grid	C_{ag}	=	30	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	12	kV
Anode current	I_a	=	2	A
Amplification factor	μ	=	34	
Mutual conductance	S	=	20	mA/V

TEMPERATURE LIMIT (Absolute limit)

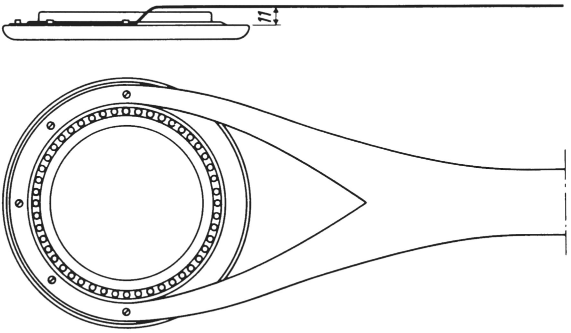
Seal temperature = max. 220 °C

7Z2 8674

AIR COOLING CHARACTERISTICS

W_a (kW)	h (m)	t_i (^{o}C)	q_{min} (m^3/min)	p_i (mm H_2O)
7	0	35	6.6	10
	0	45	7.7	13
	1500	35	7.9	12
	3000	25	8.3	12
10	0	35	10.5	23
	0	45	12.3	31
	1500	35	12.6	28
	3000	25	13.2	27
15	0	35	18.1	60
	0	45	21.2	79
	1500	35	21.7	73
	3000	25	22.8	70

To ensure a uniform R.F. current distribution in the grid seal especially at frequencies higher than 4 MHz, the grid lead should be connected as shown below

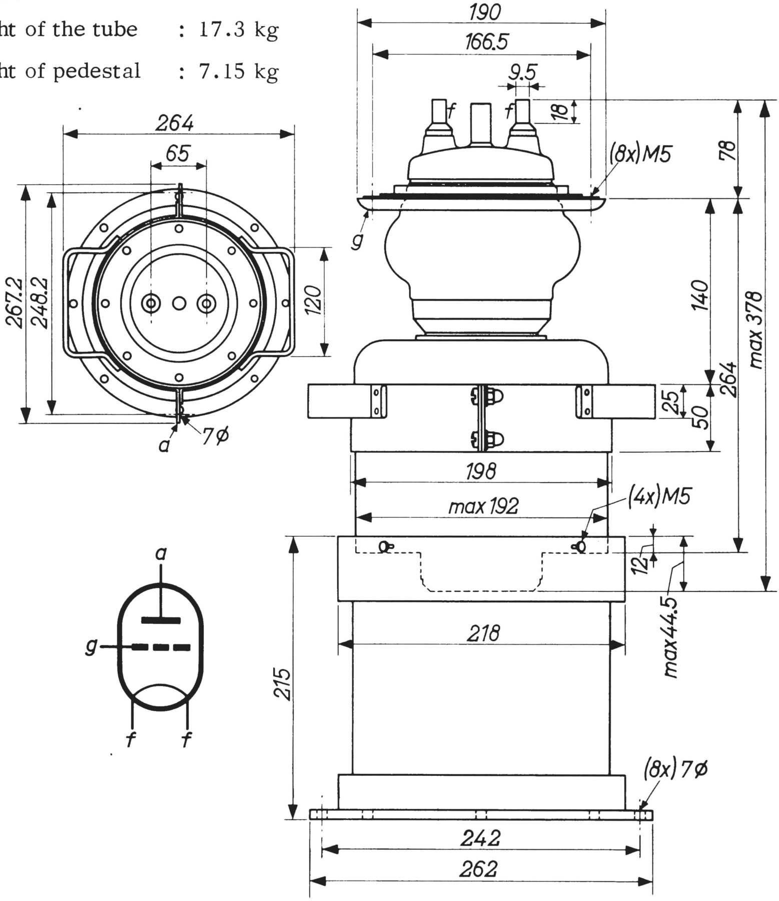


7Z2 3548

MECHANICAL DATA

Dimensions in mm

Filament connectors with cable	: 40662
Grid connector	: 40663
Insulating pedestal	: 40648
Net weight of the tube	: 17.3 kg
Net weight of pedestal	: 7.15 kg



264
65
267.2
248.2
120
a
7ø
190
166.5
9.5
f
f
18
(8x)M5
78
g
140
max 378
264
25
50
198
max 192
(4x)M5
12
max 44.5
218
215
(8x)7ø
242
262
a
g
f
f

Mounting position: vertical with anode down

7Z2 8675

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from three-phase half-wave rectifier without filter

LIMITING VALUES (Absolute limits)

Frequency	f		up to	30	MHz
Anode voltage	V_a	=	max.	13	kV
Anode current	I_a	=	max.	4.8	A
Anode dissipation	W_a	=	max.	15	kW
Anode input power	W_{ia}	=	max.	60	kW
Negative grid voltage	$-V_g$	=	max.	1500	V
Grid current	I_g	=	max.	0.8	A
Grid circuit resistance	R_g	=	max.	10	kΩ

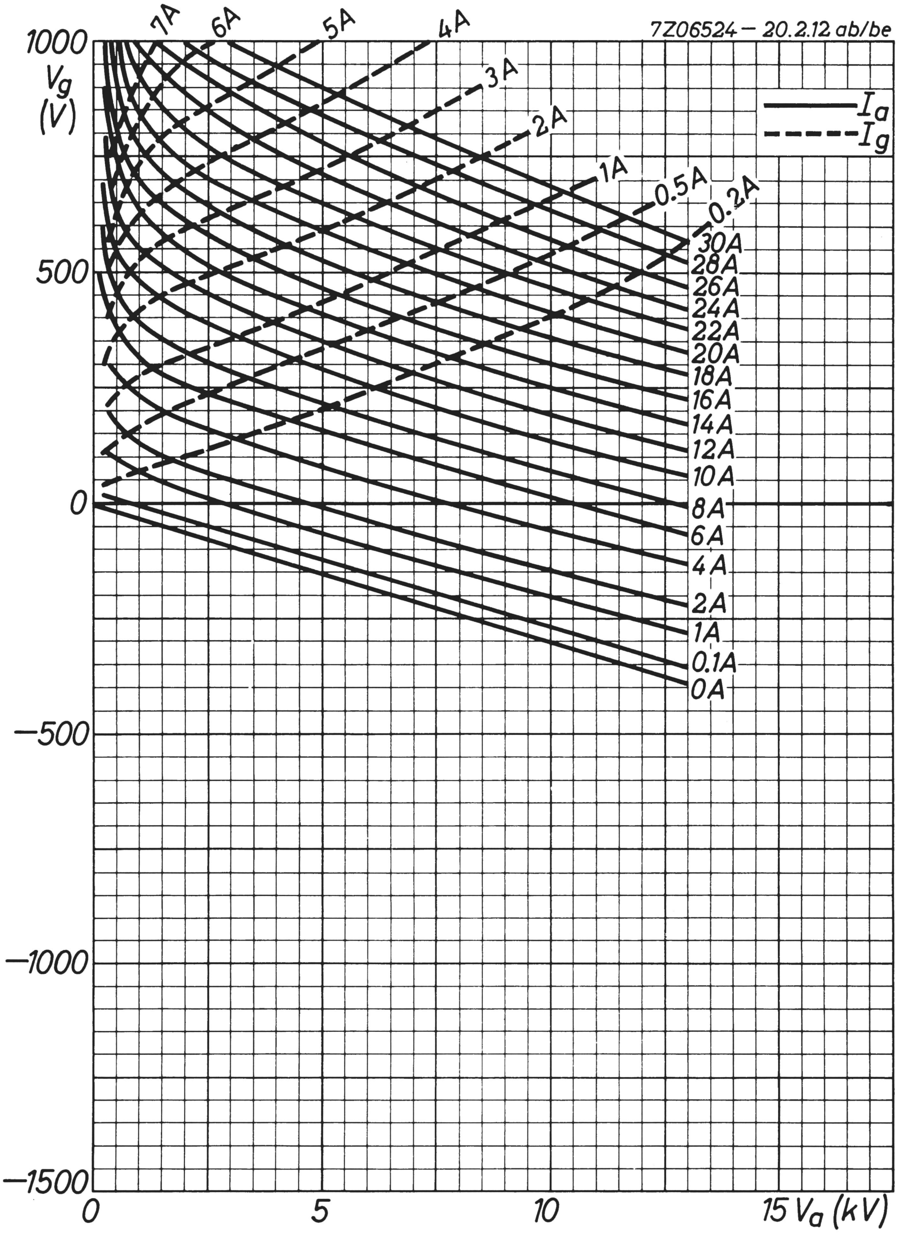
OPERATING CONDITIONS

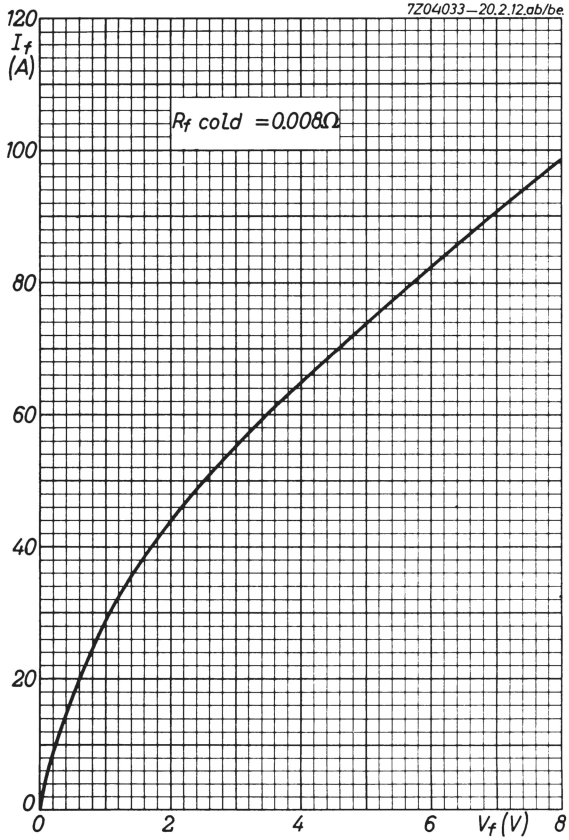
Frequency	f	=	30	30	30	MHz
Transformer voltage	V_{tr}	=	8.9	7.4	6.0	kV
Anode voltage	V_a	=	12	10	8	kV
Anode current, loaded	I_a	=	3.2	3.2	3.2	A
Anode current, unloaded	I_a	=	0.52	0.50	0.48	A
Grid current, loaded	I_g	=	0.50	0.50	0.50	A
Grid current, unloaded	I_g	=	0.74	0.77	0.80	A
Grid resistor	R_g	=	2.0	1.6	1.1	kΩ
Load resistance	$R_{a\sim}$	=	1800	1450	1100	Ω
Feedback ratio under loaded conditions	$V_{g\sim}/V_{a\sim}$	=	16	17	19	%
Anode input power	W_{ia}	=	38.4	32.0	25.6	kW
Anode dissipation	W_a	=	9.4	8.7	7.7	kW
Output power	W_o	=	29.0	23.3	17.9	kW
Efficiency	η	=	75.5	72.5	70	%
Output power in the load	W_ℓ	=	25	20	15.5	kW ¹)

---

¹) Useful power in the load measured in a circuit having an efficiency of about 90%

7Z2 3550


7Z06524 – 20.2.12 ab/be
1000
V_g
(V)
500
0
−500
−1000
−1500
0
5
10
15 V_a (kV)
I_a
I_g
7A
6A
5A
4A
3A
2A
1A
0.5A
0.2A
30A
28A
26A
24A
22A
20A
18A
16A
14A
12A
10A
8A
6A
4A
2A
1A
0.1A
0A


7Z04033—20.2.12.ab/be.
120
I_f
(A)
R_f cold =0.008Ω
100
80
60
40
20
0
0
2
4
6
V_f (V)
8

AIR COOLED
INDUSTRIAL R.F. POWER TRIODE

QUICK REFERENCE DATA

Industrial R.F. oscillator class C

Freq. (MHz)	three phase	
	V_a (kV)	W_o (kW)
30	12	39
	10	31.3
	8	23.2

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	8	V	+ 5 % -10 %
Filament current	I_f	=	130	A	
Cold filament resistance	R_{fo}	=	0.006	Ω	

The filament current must never exceed a peak value of 280 A at any time during the initial energizing schedule

CAPACITANCES

Anode to all other elements except grid	C_a	=	0.9	pF
Grid to all other elements except anode	C_g	=	45	pF
Anode to grid	C_{ag}	=	23.5	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	12	kV
Anode current	I_a	=	2	A
Mutual conductance	S	=	25	mA/V
Amplification factor	μ	=	21	

TEMPERATURE LIMITS (Absolute limits)

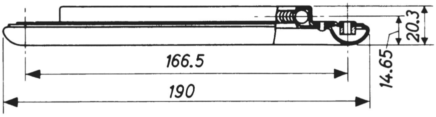
Temperature of all seals = max. 220 °C

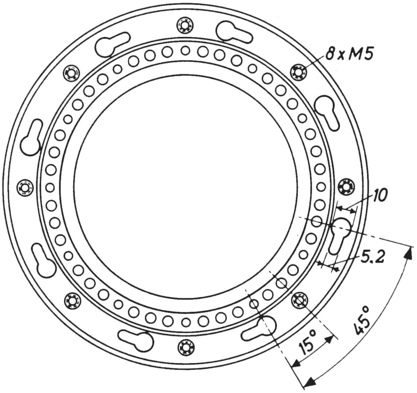
AIR COOLING CHARACTERISTICS See also cooling curves on page 8

W_a (kW)	h (m)	t_i (°C)	q_{min} (m^3/min)	P_i (mm H_2O)
7	0	35	6.6	10
	0	45	7.7	13
	1500	35	7.9	12
	3000	25	8.3	12
10	0	35	10.5	23
	0	45	12.3	31
	1500	35	12.6	28
	3000	25	13.2	27
15	0	35	18.1	60
	0	45	21.2	79
	1500	35	21.7	73
	3000	25	22.8	70

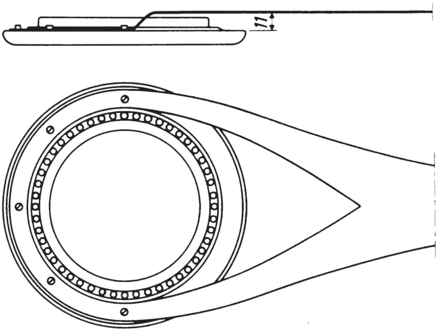
MECHANICAL DATA

Dimensions in mm





Grid connector 40663



Connection of the grid lead

The rounded side of the grid connector should face the anode. To ensure a uniform RF current distribution in the grid seal at frequencies higher than 4 MHz, the grid lead should be connected as shown in the figure at right.

MECHANICAL DATA (continued)

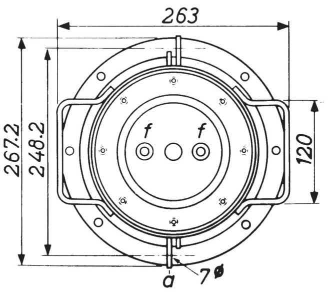
Filament connectors : 40662

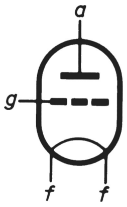
Grid connector : 40663

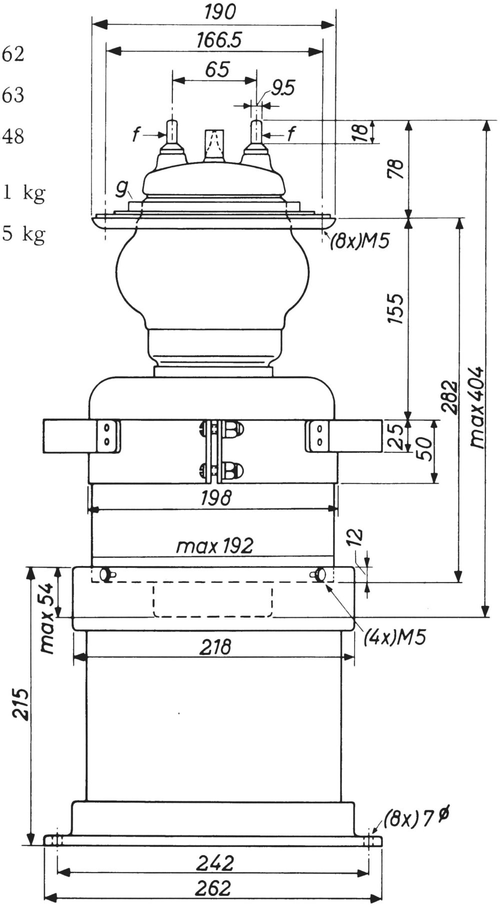
Insulating pedestal : 40648

Net weight of tube : 16.1 kg

Net weight of pedestal : 7.15 kg


263
267.2
248.2
120
f
f
a
7ø




190
166.5
65
9.5
f
f
g
18
78
(8x)M5
155
282
max 404
25
50
198
max 192
12
max 54
(4x)M5
218
215
(8x) 7ø
242
262

Mounting position: vertical

Dimensions in mm

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from three-phase rectifier without filter

LIMITING VALUES (Absolute limits)

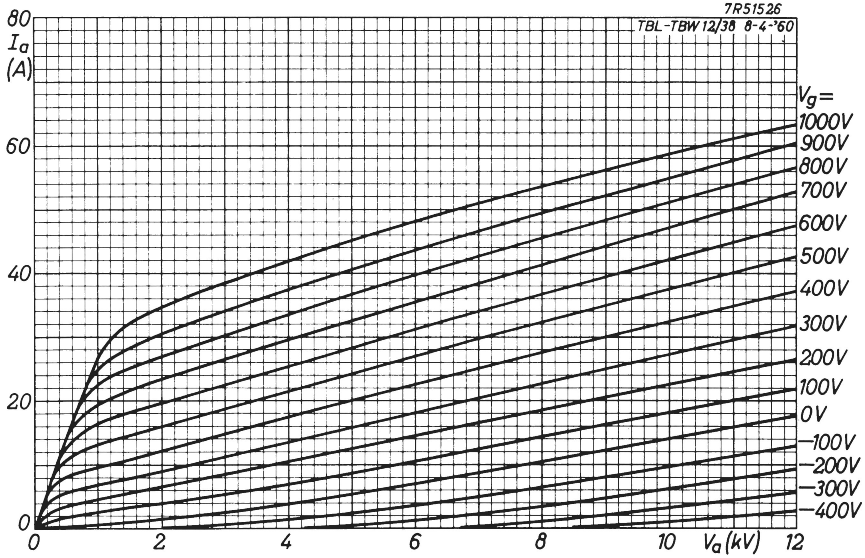
Frequency	f		up to	30	MHz
Anode voltage	V_a	=	max.	13	kV
Anode current	I_a	=	max.	5	A
Anode dissipation	W_a	=	max.	15	kW
Anode input power	W_{ia}	=	max.	60	kW
Negative grid voltage	$-V_g$	=	max.	2	kV
Grid current, loaded	I_g	=	max.	1.5	A
Grid current, unloaded	I_g	=	max.	2.0	A
Grid circuit resistance	R_g	=	max.	10	kΩ

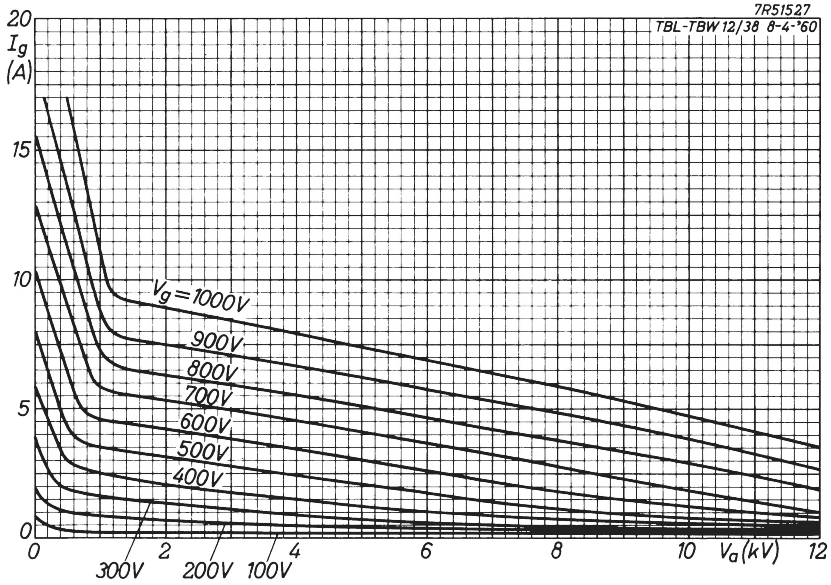
OPERATING CONDITIONS

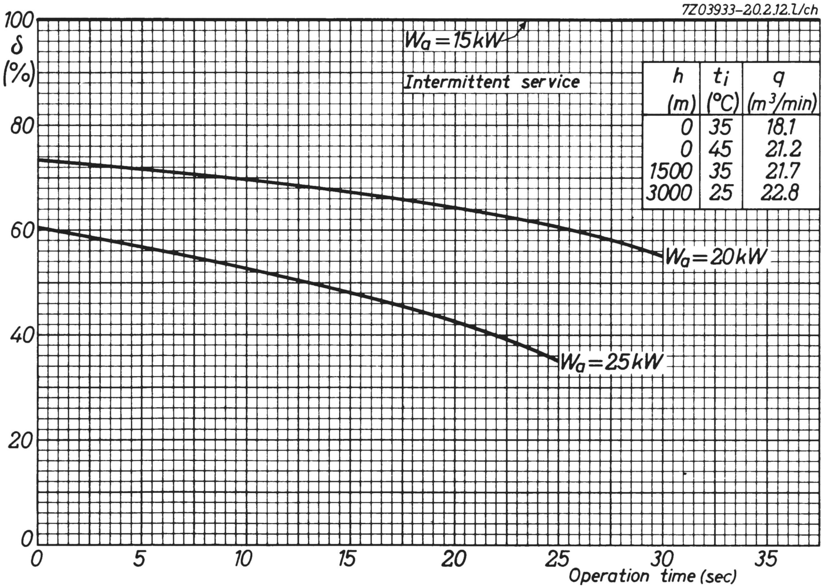
Frequency	f	=	30	30	30	MHz
Anode voltage	V_a	=	12	10	8	kV
Anode current, loaded	I_a	=	4.5	4.5	4.5	A
Anode current, unloaded	I_a	=	0.65	0.63	0.62	A
Grid current, loaded	I_g	=	0.9	0.9	0.9	A
Grid current, unloaded	I_g	=	1.22	1.3	1.35	A
Grid resistor	R_g	=	1100	1000	900	Ω
Load resistance	$R_{a\sim}$	=	1450	1100	800	Ω
Feedback ratio under loaded conditions	$V_{g\sim}/V_{a\sim}$	=	16	19	24	%
Anode input power	W_{ia}	=	54	45	36	kW
Anode dissipation	W_a	=	15	13.7	12.8	kW
Output power	W_o	=	39	31.3	23.2	kW
Efficiency	η	=	72.5	70	64.5	%
Output power in the load	W_ℓ	=	30	25	18	kW (1)

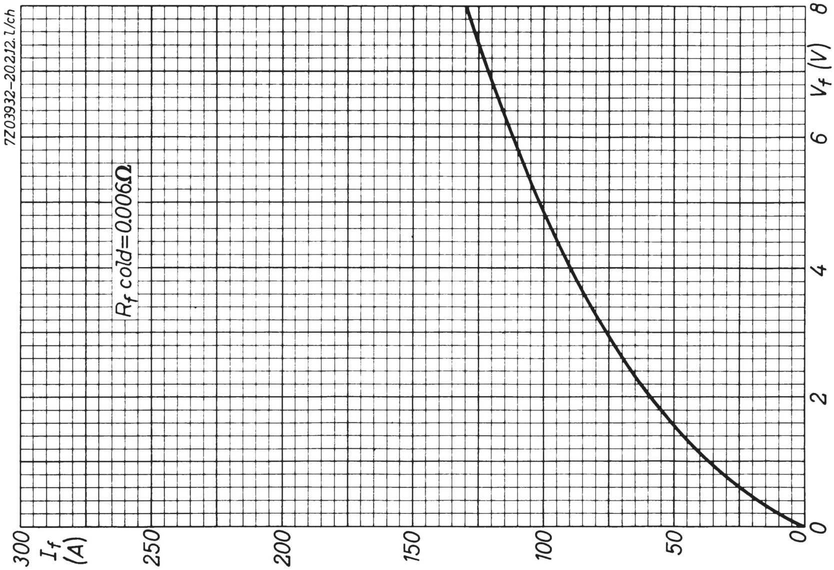
---

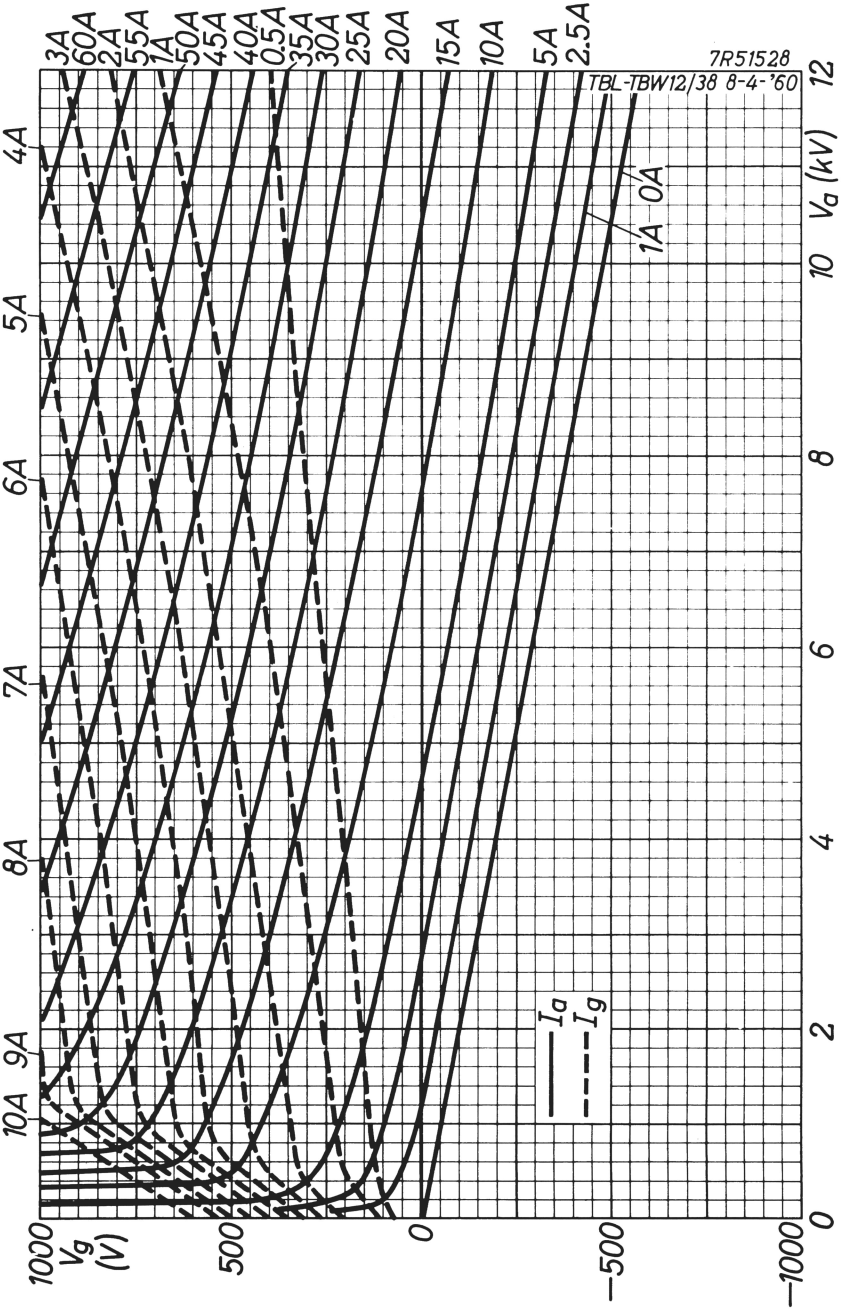
(1) Useful power in the load, measured in a circuit having an efficiency of about 85%.

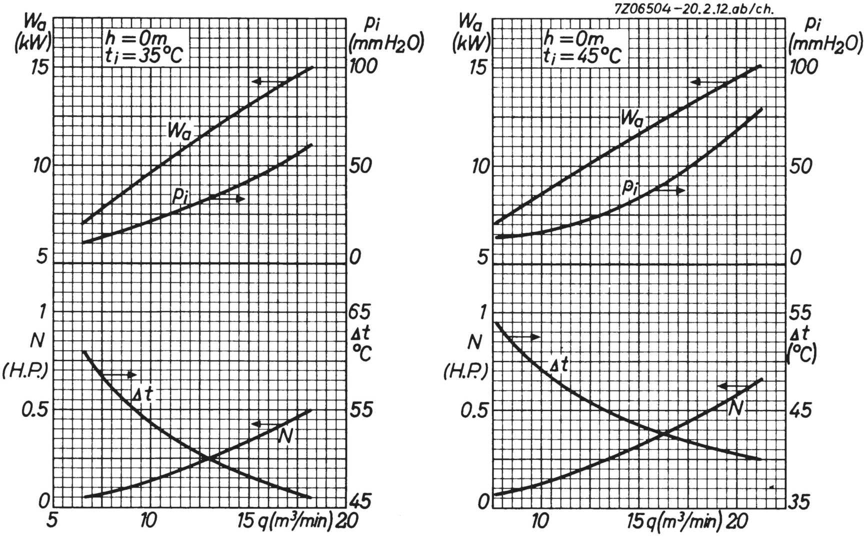

7R51526
TBL-TBW 12/38 8-4-'60
80
I_a
(A)
60
40
20
0
V_g=
1000V
900V
800V
700V
600V
500V
400V
300V
200V
100V
0V
−100V
−200V
−300V
−400V
0
2
4
6
8
10
V_a(kV)
12


7R51527
TBL-TBW 12/38 8-4-'60
20
I_g
(A)
15
10
5
0
V_g=1000V
900V
800V
700V
600V
500V
400V
300V
200V
100V
0
2
4
6
8
10
V_a(kV)
12

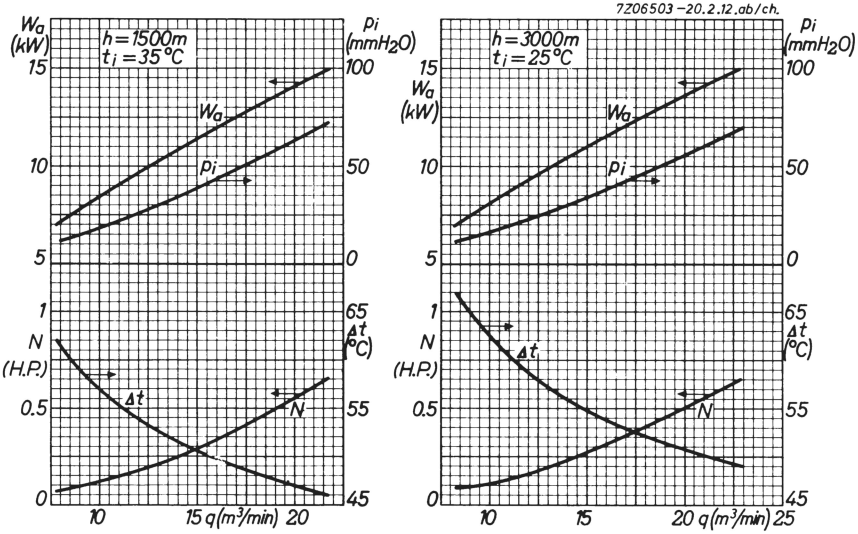

7Z03933-20.2.12.1/ch
100
δ
(%)
80
60
40
20
0
Wa = 15 kW
Intermittent service
h (m)
ti (°C)
q (m³/min)
0 35 18.1
0 45 21.2
1500 35 21.7
3000 25 22.8
Wa = 20 kW
Wa = 25 kW
0
5
10
15
20
25
30
35
Operation time (sec)


7Z03932-20.2.12.1/ch
Rf cold = 0.006Ω
8
Vf (V)
6
4
2
0
300
If (A)
250
200
150
100
50
0


7R51528
TBL-TBW12/38 8-4-'60
3A
60A
2A
55A
1A
50A
45A
40A
0.5A
35A
30A
25A
20A
15A
10A
5A
2.5A
4A
5A
6A
7A
8A
9A
10A
0A
1A
V_a (kV)
12
10
8
6
4
2
0
V_g (V)
1000
500
0
−500
−1000
I_a
I_g



7Z06504-20.2.12.ab/ch.



7Z06503-20.2.12.ab/ch.

AIR COOLED R.F. POWER TRIODE

QUICK REFERENCE DATA

Freq. (MHz)	C telegr.		C_a mod.		B mod. 1)	
	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)
30	12	41	10	27.5	10	19.2

HEATING: direct; filament thoriated tungsten

Filament voltage V_f = 8 V

Filament current I_f = 130 A

The filament current must never exceed a peak value of 280 A at any time during the initial energizing schedule

CAPACITANCES

Anode to all other elements except grid C_a = 0.6 pF

Grid to all other elements except anode C_g = 45 pF

Anode to grid C_{ag} = 27 pF

TYPICAL CHARACTERISTICS

Anode voltage V_a = 12 kV

Anode current I_a = 2 A

Mutual conductance S = 25 mA/V

Amplification factor μ 33

TEMPERATURE LIMITS (Absolute limits)

Temperature of all seals = max. 220 °C

---

1) Two tubes

AIR COOLING CHARACTERISTICS

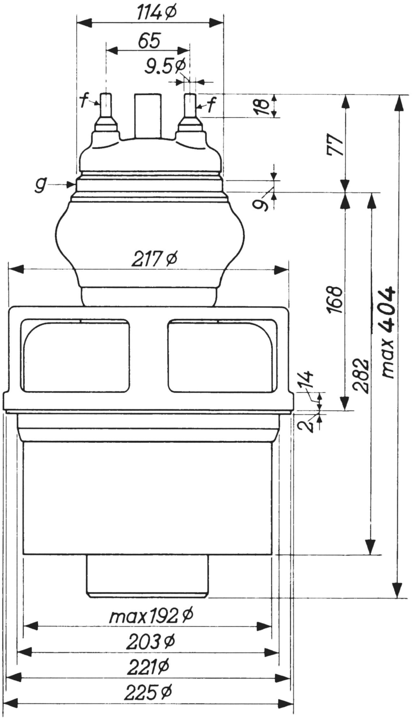
W_a (kW)	h (m)	t_i (^oC)	q_{min} (m^3/min)	p_i (mm H_2O)
7	0	35	6.6	10
	0	45	7.7	13
	1500	35	7.9	12
	3000	25	8.3	12
10	0	35	10.5	23
	0	45	12.3	31
	1500	35	12.6	28
	3000	25	13.2	27
15	0	35	18.1	60
	0	45	21.2	79
	1500	35	21.7	73
	3000	25	22.8	70

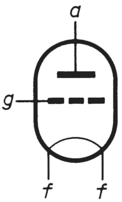
MECHANICAL DATA

Dimensions in mm

Net weight of tube : 19 kg

Net weight of pedestal: 7.15 kg


114⌀
65
9.5⌀
f
f
18
77
g
9
217⌀
168
282
max 404
14
2
max192⌀
203⌀
221⌀
225⌀



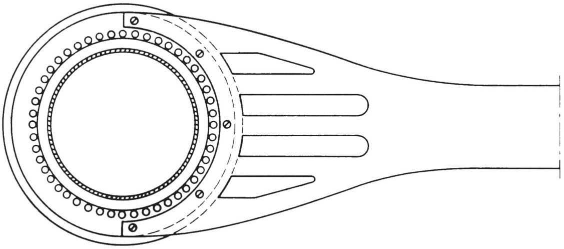
Mounting position: vertical

ACCESSORIES

Dimensions in mm

Connectors with cable for filament:	40662
Insulating pedestal	40648
Grid connector	40663

The rounded side of the grid connector should face the anode. To ensure a uniform R.F. current distribution in the grid seal at frequencies higher than 4 MHz, the grid lead should be connected as shown below



R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

Frequency	f		up to	30	MHz
Anode voltage	V_a	=	max.	13	kV
Anode input power	W_{ia}	=	max.	60	kW
Anode dissipation	W_a	=	max.	15	kW
Anode current	I_a	=	max.	4.8	A
Negative grid voltage	$-V_g$	=	max.	1500	V
Grid current	I_g	=	max.	1.0	A
Grid circuit resistance	R_g	=	max.	10	kΩ

OPERATING CONDITIONS

Frequency	f	=	30	MHz
Anode voltage	V_a	=	12	kV
Grid voltage	V_g	=	-1000	V
Anode current	I_a	=	4.5	A
Grid current	I_g	=	0.8	A
Peak grid A.C. voltage	V_{gp}	=	1600	V
Grid input power	W_{ig}	=	1150	W
Anode input power	W_{ia}	=	54	kW
Anode dissipation	W_a	=	13	kW
Output power	W_o	=	41	kW
Efficiency	η	=	76	%

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

Frequency	f		up to	30	MHz
Anode voltage	V_a	=	max.	10	kV [1]
Anode input power	W_{ia}	=	max.	40	kW
Anode dissipation	W_a	=	max.	10	kW
Anode current	I_a	=	max.	3.8	A
Negative grid voltage	$-V_g$	=	max.	1500	V
Grid current	I_g	=	max.	1.0	A
Grid circuit resistance	R_g	=	max.	10	kΩ

OPERATING CONDITIONS

Frequency	f	=	30	MHz
Anode voltage	V_a	=	10	kV
Grid voltage	V_g	=	-1000	V [2]
Anode current	I_a	=	3.5	A
Grid current	I_g	=	0.8	A
Peak grid A.C. voltage	V_{gp}	=	1500	V
Grid input power	W_{ig}	=	1080	W
Anode input power	W_{ia}	=	35	kW
Anode dissipation	W_a	=	7.5	kW
Output power	W_o	=	27.5	kW
Efficiency	η	=	78.5	%
Modulation factor	m	=	100	%
Modulation power	W_{mod}	=	17.5	kW

---

[1] With 120% modulation and 3000 m above sea level

[2] Grid bias partially obtained by a grid resistor

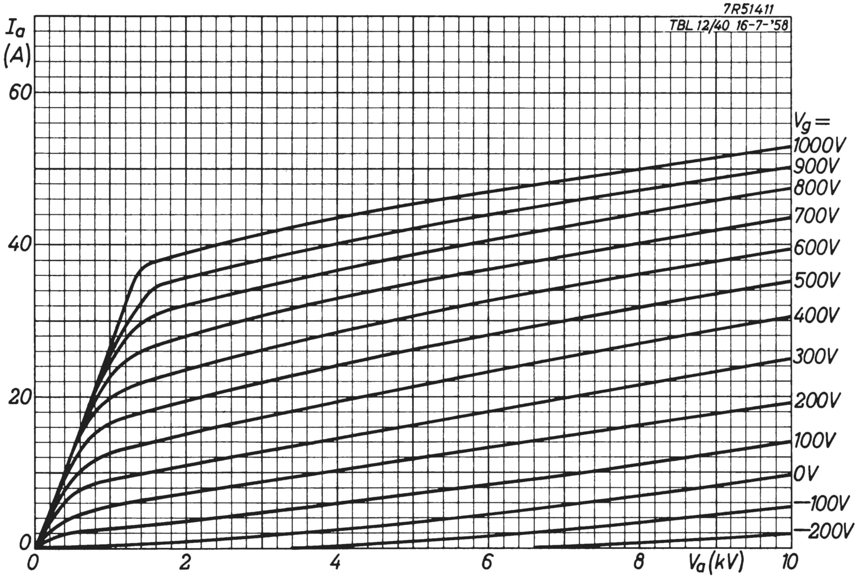
A.F. CLASS B AMPLIFIER AND MODULATOR (especially for use with a cathode-follower)

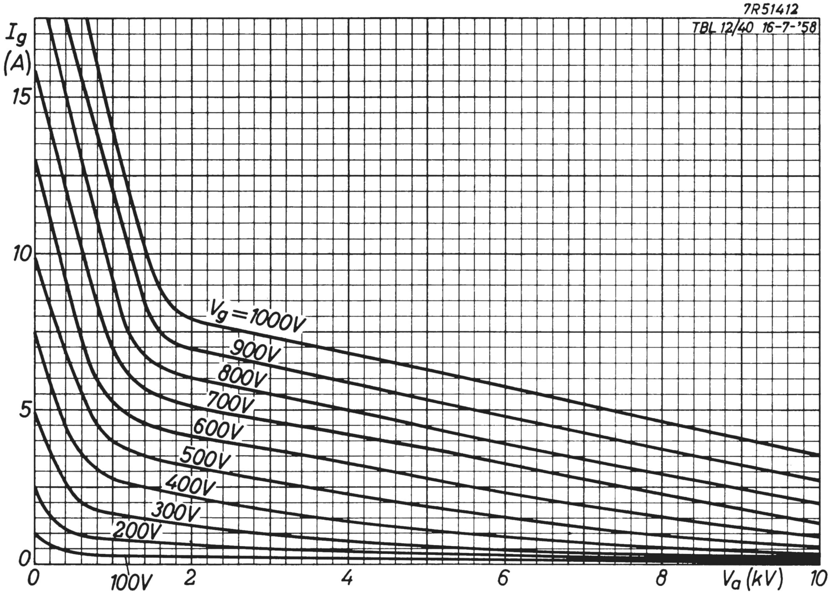
LIMITING VALUES (Absolute limits)

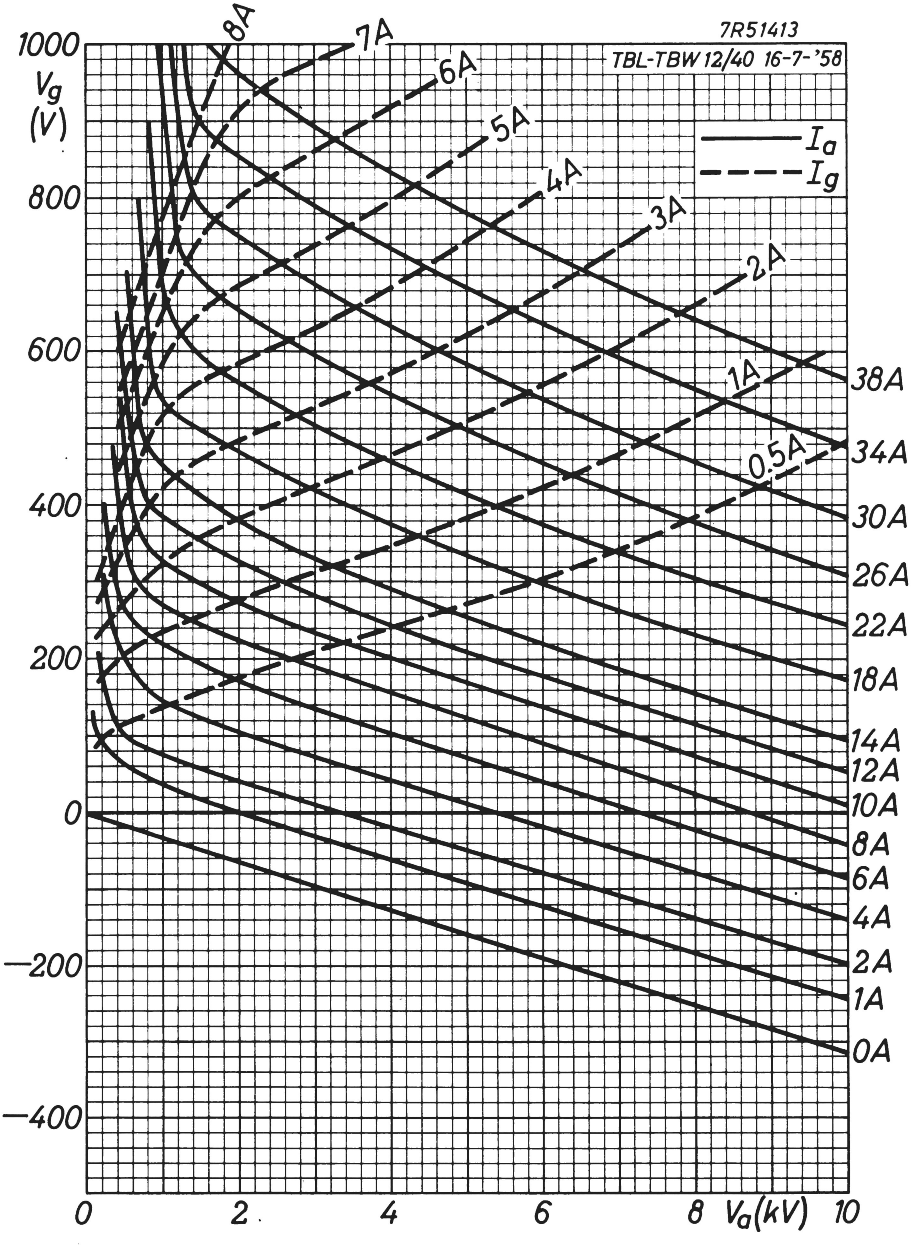
Anode voltage	V_a	=	max.	13	kV
Anode input power	W_{ia}	=	max.	60	kW
Anode dissipation	W_a	=	max.	15	kW
Anode current	I_a	=	max.	4.5	A
Grid circuit resistance	R_g	=	max.	10	kΩ

OPERATING CONDITIONS, two tubes

Anode voltage	V_a	=	10		kV
Grid voltage	V_g	=	−290		V
Load resistance	$R_{aa\sim}$	=	6240		Ω
Peak grid to grid A.C. voltage	V_{ggp}	=	0	900	V
Anode current	I_a	=	2x0.1	2x1.6	A
Grid current	I_g	=	0	2x0.035	A
Peak grid current	I_{gp}	=	–	2x0.24	A
Grid input power	W_{ig}	=	0	2x14	W
Anode input power	W_{ia}	=	2x1.0	2x16	kW
Anode dissipation	W_a	=	2x1.0	2x6.4	kW
Output power	W_o	=	0	19.2	kW
Efficiency	η	=	–	60	%


7R51411
TBL 12/40 16-7-'58
I_a (A)
60
40
20
0
V_g =
1000V
900V
800V
700V
600V
500V
400V
300V
200V
100V
0V
—100V
—200V
0
2
4
6
8
V_a (kV)
10


7R51412
TBL 12/40 16-7-'58
I_g (A)
15
10
5
0
V_g=1000V
900V
800V
700V
600V
500V
400V
300V
200V
100V
0
2
4
6
8
V_a (kV)
10


7R51413
TBL-TBW 12/40 16-7-'58
1000
800
600
400
200
0
−200
−400
V_g (V)
0
2
4
6
8
10
V_a (kV)
I_a
I_g
8A
7A
6A
5A
4A
3A
2A
1A
0.5A
38A
34A
30A
26A
22A
18A
14A
12A
10A
8A
6A
4A
2A
1A
0A

AIR COOLED R.F. POWER TRIODE

QUICK REFERENCE DATA

General purposes

λ (m)	Freq. (MHz)	C telegr.		C an.mod.		B mod. [1]	
		V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)
20	15	12	108	10	80	12	202
15	20	12	94.5	10	54.5	10	116
12	25	11	70	9	42.5	10	77
11	27.5	10.5	59	8.5	36.5	9	62
10	30	10	50	8	31	8.5	54
						8	46.8

Television service

Freq. (MHz)	Neg. mod., pos. sync. [1]	
	V_a (kV)	W_o sync (kW)
48-68	6.5	100 [2]

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	17.5	V
Filament current	I_f	=	196	A
Cold filament resistance	R_{fo}	=	0.012	Ω

The filament current must never exceed a peak value of 420 A at any time during the intial energizing schedule

CAPACITANCES

Anode to all other elements except grid	C_a	=	3.4	pF
Grid to all other elements except anode	C_g	=	116	pF
Anode to grid	C_{ag}	=	86	pF

---

[1] Two tubes

[2] Power transferred from driving stage included

7Z2 8679

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	3	10	kV
Anode current	I_a	=	50	5	A
Amplification factor	μ	=	–	27	
Mutual conductance	S	=	–	50	mA/V
Maximum mutual conductance	S_{max}	=	92	–	mA/V

TEMPERATURE LIMITS (Absolute limits)

Temperature of seals = max. 180 °C

AIR COOLING CHARACTERISTICS; see also cooling curves

W_a (kW)	h (m)	t_i (°C)	q_{min} (m^3/min)	p_i (mm H_2O)
30	0	35	35	114
	0	45	40	143
	1500	35	42	136
	3000	25	44	132
45	0	35	54	275
	0	45	62.5	335
	1500	35	64.5	322
	3000	25	68	319

When the tube is used at frequencies above 6 MHz, special attention must be paid to the anode and grid-seal temperatures.
Cooling of these seals is effected by air flowing through the slots provided at the top of the cooler housing. In certain cases, e.g. at low anode dissipation and with cooling by the minimum quantity of air (according to the cooling curves), the air flow to the seals will not be sufficient to maintain the seal temperatures below the maximum permissible value at frequencies above 6 MHz.
Consequently, in these cases, a larger quantity of air must be supplied.

When using the special filament connectors type No. 40628, together with connecting leads of adequate cross-section, additional air cooling of the filament terminals is, as a rule, not necessary.

Care should be taken to ensure firm contact of the filament terminals in order to obtain equal distribution of current over these terminals.

7Z2 8680

MECHANICAL DATA

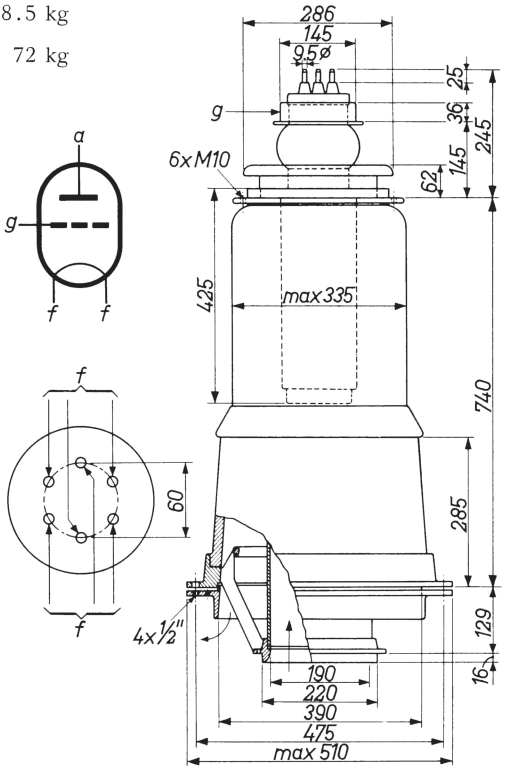
Dimensions in mm

Clips for filament : 40628

Cooler housing : K506

Net weight of the tube: 28.5 kg

Net weight of K506 : 72 kg


a
g
f
f
f
f
60
286
145
9.5⌀
g
6xM10
25
36
245
145
62
425
max 335
740
285
129
16
4x½"
190
220
390
475
max 510

Tube mounted in cooler housing type K506

Mounting position: vertical with anode down

When connecting the filament the three pins of each group must be joined

7Z2 3581

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

Frequency	f	up to	4	15	30	MHz
Anode voltage	V_a	max.	15	13.5	10	kV
Anode current	I_a	max.	12	12	10	A
Anode input power	W_{ia}	max.	162	162	80	kW
Anode dissipation	W_a	max.		45		kW
Negative grid voltage	$-V_g$	max.		1200		V
Grid current	I_g	max.		3		A

OPERATING CONDITIONS

Wavelength	λ	=	20	15	12	11	10	m
Frequency	f	=	15	20	25	27.5	30	MHz
Anode voltage	V_a	=	12	12	11	10.5	10	kV
Grid voltage	V_g	=	-1000	-1000	-900	-850	-800	V
Anode current	I_a	=	12	10.5	8.5	7.5	6.7	A
Grid current	I_g	=	2.25	2	1.6	1.5	1.4	A
Peak grid A.C. voltage	V_{gp}	=	1700	1650	1450	1350	1300	V
Grid input power	W_{ig}	=	3.5	3	2.1	1.9	1.7	kW
Anode input power	W_{ia}	=	144	126	93.5	79	67	kW
Anode dissipation	W_a	=	36	31.5	23.5	20	17	kW
Output power	W_o	=	108	94.5	70	59	50	kW
Efficiency	η	=	75	75	75	75	75	%

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

Frequency	f		up to 15	20	30	MHz
Anode voltage	V_a	=	max. 10	10	8	kV
Anode input power	W_{ia}	=	max. 105	80	50	kW
Anode dissipation	W_a	=		max. 30		kW
Anode current	I_a	=		max. 10.5		A
Negative grid voltage	$-V_g$	=		max. 1200		V
Grid current	I_g	=		max. 3.5		A

OPERATING CONDITIONS

f	=	15	15	20	25	27.5	30 MHz
V_a	=	10	10	10	9	8.5	8 kV
V_g	=	-1050	-1050	-1050	-925	-900	-850 V [1]
I_a	=	10.5	8.5	7.0	6.2	5.7	5.25 A
I_g	=	3.5	2.6	2.0	2.0	1.9	1.8 A
V_{gp}	=	1960	1750	1650	1500	1450	1400 V
W_{ig}	=	6.2	4.1	3.0	2.7	2.5	2.3 kW
W_{ia}	=	105	85	70	56	48.5	42 kW
W_a	=	25	17	15.5	13.5	12	11 kW
W_o	=	80	68	54.5	42.5	36.5	31 kW
η	=	76	80	78	76	75	74 %
m	=	100	100	100	100	100	100 %
W_{mod}	=	52.5	42.5	35	28	24.5	21 kW

---

[1] Grid bias partially obtained by the grid resistor

7Z2 8682

A.F. CLASS B AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	=	max.	15	kV
Anode current	I_a	=	max.	12	A
Anode input power	W_{ia}	=	max.	162	kW
Anode dissipation	W_a	=	max.	45	kW
Grid circuit resistance	R_g	=	max.	20	kΩ

OPERATING CONDITIONS, two tubes

V_a	=	12		10		10		kV
V_g	=	−450		−375		−400		V
$R_{aa\sim}$	=	1200		1500		2060		Ω
V_{gg_p}	=	0	2060	0	1680	0	1460	V
I_a	=	2x0.65	2x12	2x0.5	2x7.9	2x0.2	2x5.4	A
I_g	=	0	2x2.5	0	2x1.9	0	2x0.7	A
W_{ig}	=	0	2x2.4	0	2x1.44	0	2x0.5	kW
W_{ia}	=	2x7.8	2x144	2x5	2x79	2x2	2x54	kW
W_a	=	2x7.8	2x43	2x5	2x21	2x2	2x15.5	kW
W_o	=	0	202	0	116	0	77	kW
η	=	−	70	−	75	−	71	%

V_a	=	9		8.5		8		kV
V_g	=	−350		−325		−300		V
$R_{aa\sim}$	=	2080		2120		2210		Ω
V_{gg_p}	=	0	1300	0	1200	0	1120	V
I_a	=	2x0.25	2x4.8	2x0.25	2x4.4	2x0.25	2x4.1	A
I_g	=	0	2x0.65	0	2x0.55	0	2x0.4	A
W_{ig}	=	0	2x0.4	0	2x0.3	0	2x0.25	kW
W_{ia}	=	2x2.25	2x43.2	2x2.1	2x37.4	2x2	2x32.8	kW
W_a	=	2x2.25	2x12.2	2x2.1	2x10.4	2x2	2x9.4	kW
W_o	=	0	62	0	54	0	46.8	kW
η	=	−	72	−	72	−	71	%

7Z2 3584

R.F. CLASS B AMPLIFIER for television service, negative modulation, positive synchronisation

LIMITING VALUES (Absolute limits)

Frequency	f			up to	68	MHz
Anode voltage	V_a		=	max.	6.5	kV
Anode current	I_a	sync	=	max.	16	A
Anode input power	W_{ia}	sync	=	max.	100	kW
Anode dissipation	W_a	sync	=	max.	50	kW
Grid current	I_g	sync	=	max.	2	A

OPERATING CONDITIONS, two tubes in push-pull

Frequency	f		=	48 to 68	MHz 1)
Bandwidth (−1.5 dB)	B		=	5.5	MHz 2)
Bandwidth (−3 dB)	B		=	7.5	MHz 2)
Anode voltage	V_a		=	6.5	kV
Grid voltage	V_g		=	−250	V
Peak grid to grid A.C. voltage	V_{ggp}	sync	=	1740	V 3)
		black	=	1300	V 3)
Anode current	I_a	sync	=	32	A
		black	=	24	A
Grid current	I_g	sync	=	3.4	A
		black	=	2.2	A
Grid input power	W_{ig}	sync	=	22.4	kW 4)
Output power	W_o	sync	=	80+20	kW 5)
		black	=	45+11	kW 5)

---

1) In the frequency range of 60 to 68 MHz a special version of the tube is necessary.

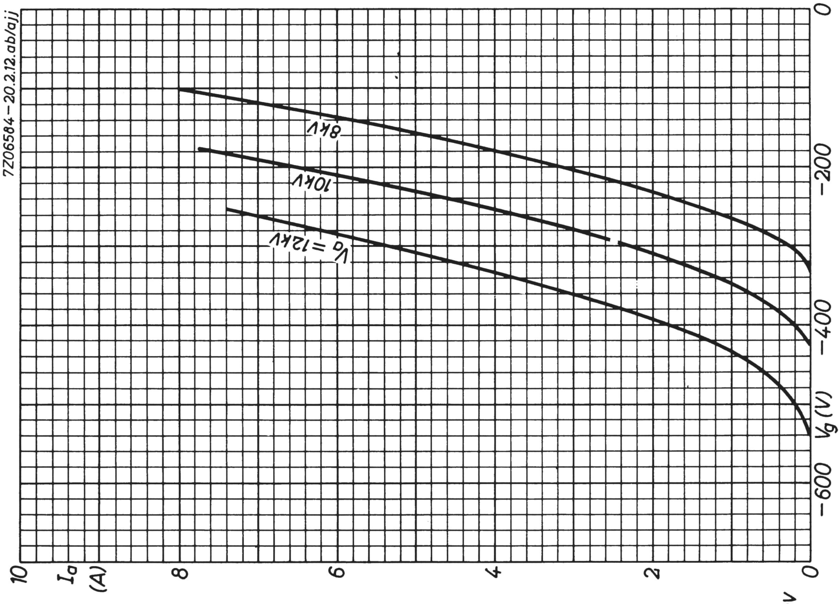
2) This value of bandwidth is based on measurements on a circuit with a single LC section

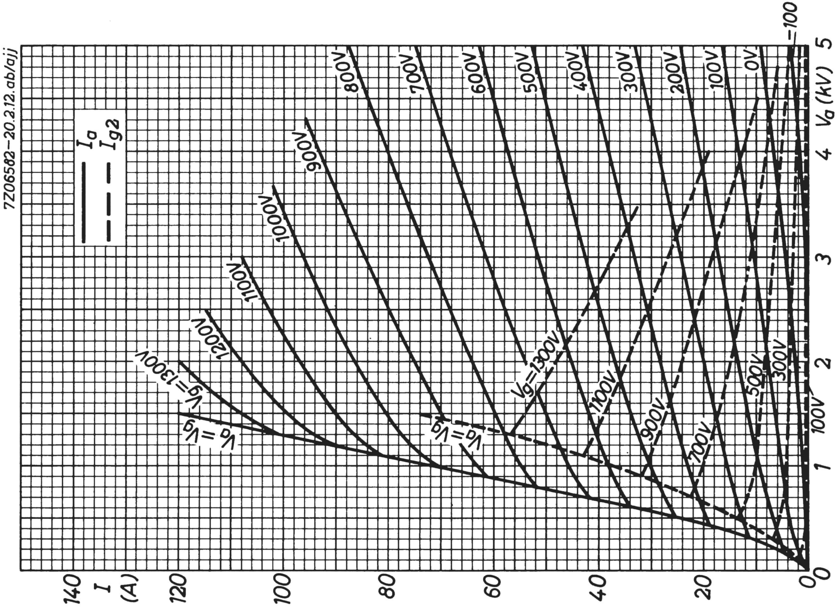
3) Measured by the slide back method

4) Driving power is accounted for largely by circuit losses. The indicated driving power is required to take care of losses in damping resistors, circuit losses and tube driving power.

5) Power transferred from driving stage included.

7Z2 8683


7Z06584-20.2.12.ab/ajj
10
I_a
(A)
8
6
4
2
0
0
−200
−400
−600
V_g (V)
V_a = 12kV
10kV
8kV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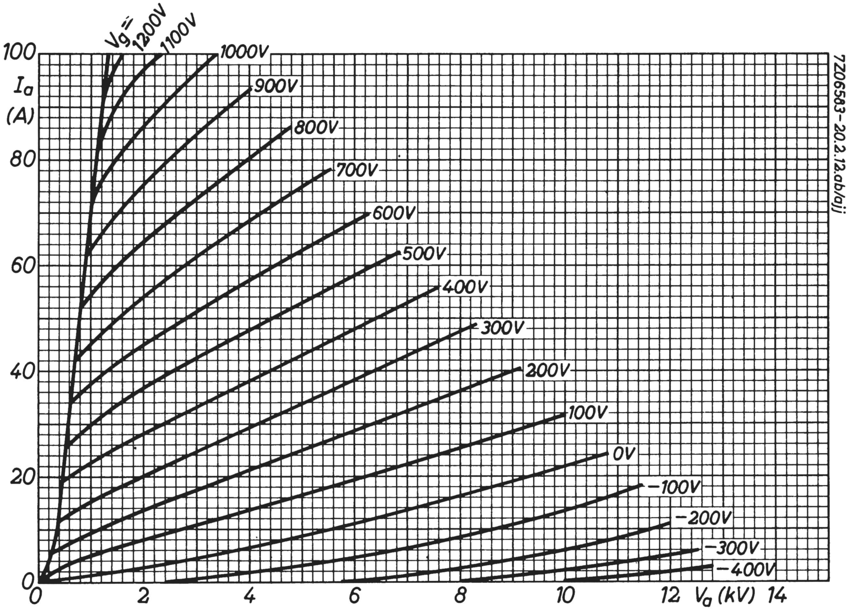
I_a
I_{g2}
140
I
(A)
120
100
80
60
40
20
0
0
1
2
3
4
5
V_a (kV)
V_g = 1300V
1200V
1100V
1000V
900V
800V
700V
600V
500V
400V
300V
200V
100V
0V
−100V
$V_a = V_g$
V_g = 1300V
1100V
900V
700V
500V
300V
100V
$V_a = V_g$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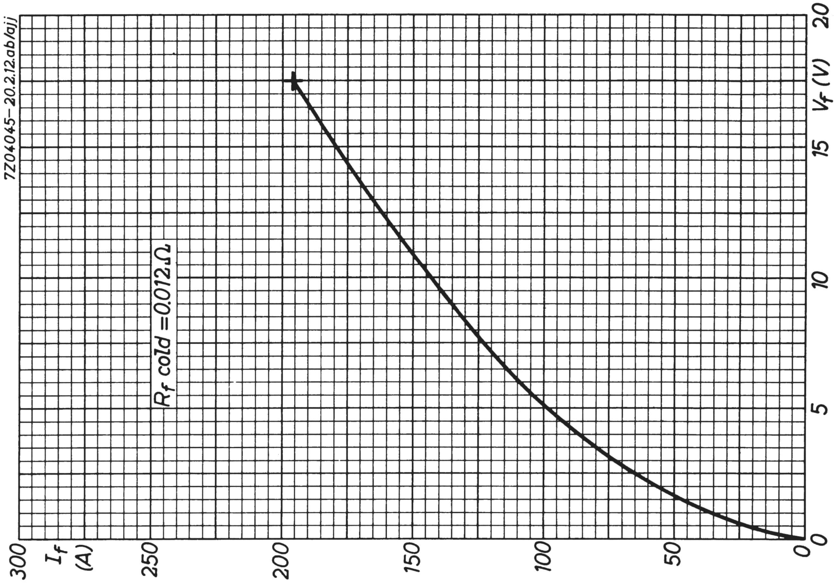
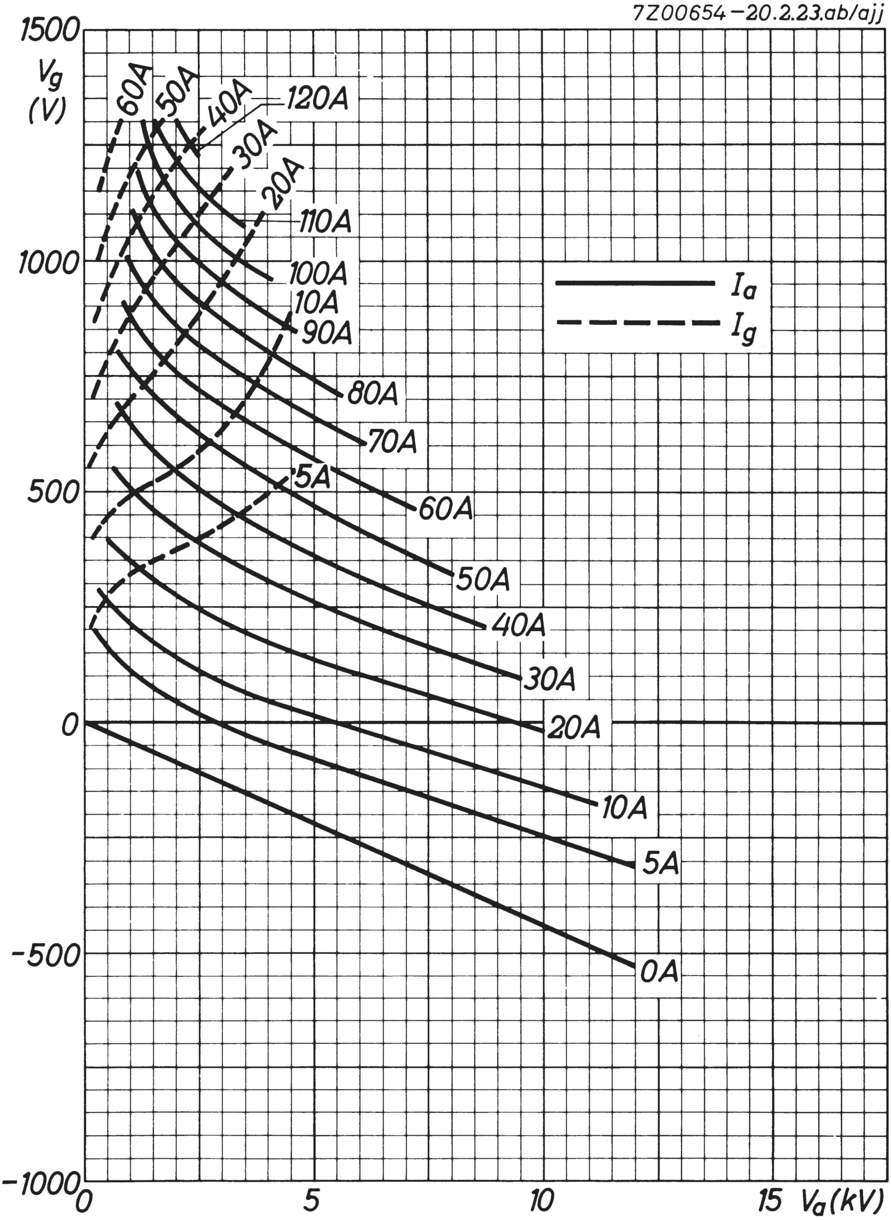
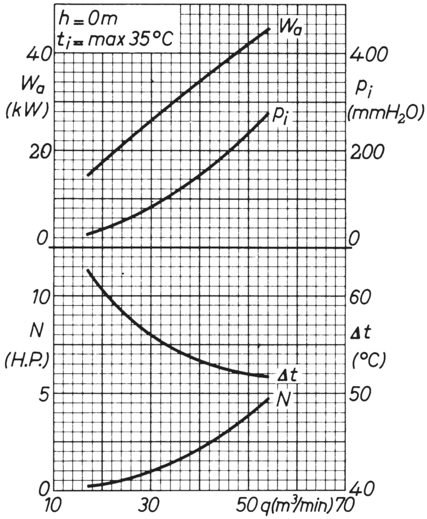
Vg=
1200V
1100V
1000V
900V
800V
700V
600V
500V
400V
300V
200V
100V
0V
−100V
−200V
−300V
−400V
Ia (A)
100
80
60
40
20
0
0
2
4
6
8
10
12
Va (kV)
14


7Z04045-20.2.12.ab/aij
Rf cold = 0.012 Ω
Vf (V)
20
15
10
5
0
If (A)
300
250
200
150
100
50
0


7Z00654–20.2.23.ab/ajj
Vg (V)
1500
1000
500
0
-500
–1000
0
5
10
15
Va (kV)
Ia
Ig
60A
50A
40A
30A
20A
10A
5A
120A
110A
100A
90A
80A
70A
60A
50A
40A
30A
20A
10A
5A
0A



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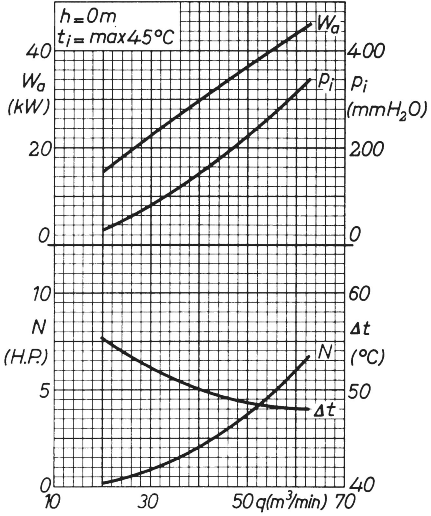

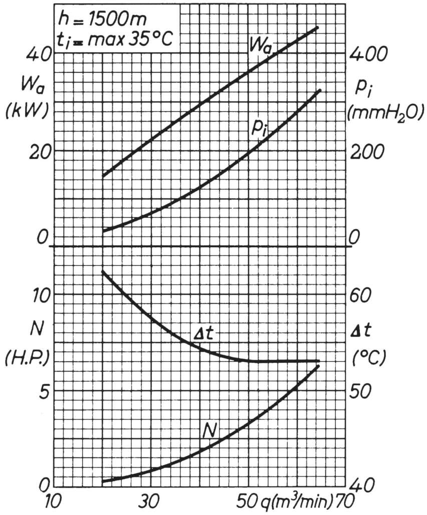

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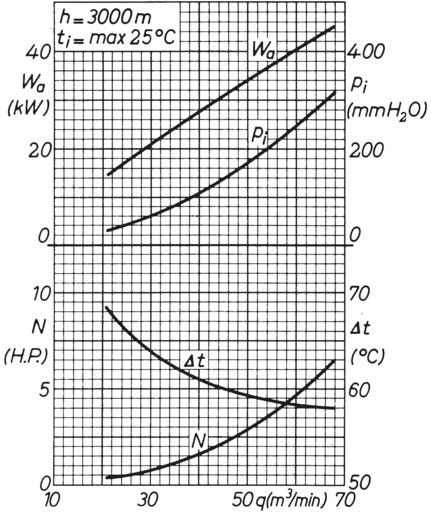
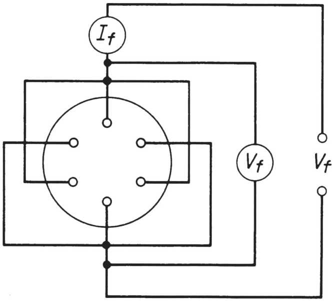


AIR COOLED R.F. POWER TRIODE

This type is equivalent to type TBL12/100 except for the filament data

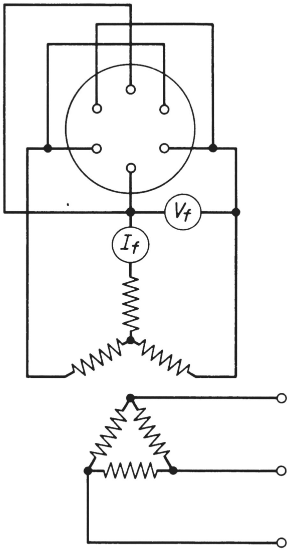


Single-phase filament energizing

V_f = 17.5 V

I_f = 196 A

Filament current must never exceed a peak value of 420 A at any time during the initial energizing schedule



Three-phase filament energizing

V_f = 15.5 V

I_f = 131 A

Filament current must never exceed a peak value of 280 A at any time during the initial energizing schedule

A safety device must be used to prevent filament energizing with one phase interrupted.

7Z2 3595

WATER COOLED
INDUSTRIAL R.F. POWER TRIODE

<table>
<tr><th colspan="3">QUICK REFERENCE DATA</th></tr>
<tr><td colspan="3">Industrial R.F. oscillator class C</td></tr>
<tr><td rowspan="2">Freq.
(MHz)</td><td colspan="2">three phase</td></tr>
<tr><td>V_a
(kV)</td><td>W_o
(kW)</td></tr>
<tr><td>30</td><td>7
6</td><td>17.7
14.3</td></tr>
</table>

HEATING: direct, filament thoriated tungsten

Filament voltage	V_f	=	6.3	V	+ 5 % -10 %
Filament current	I_f	=	130	A	
Cold filament resistance	R_{fo}	=	0.005	Ω	

The filament current must never exceed a peak value of 280 A at any time during the initial energizing schedule

CAPACITANCES

Anode to all other elements except grid	C_a	=	1.2	pF
Grid to all other elements except anode	C_g	=	44.5	pF
Anode to grid	C_{ag}	=	33.5	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	6	kV
Anode current	I_a	=	2.5	A
Mutual conductance	S	=	23	mA/V
Amplification factor	μ	=	17.5	

TEMPERATURE LIMITS (Absolute limits)

Temperature of all seals = max. 220 °C

WATER COOLING CHARACTERISTICS

W_a (kW)	t_i (°C)	q_{min} (l/min)	p_i (atm.)
5	20	4.5	0.03
	50	12	0.2
10	20	9.5	0.15
	50	22	0.6
15	20	15	0.3
	50	34	1.4

MECHANICAL DATA

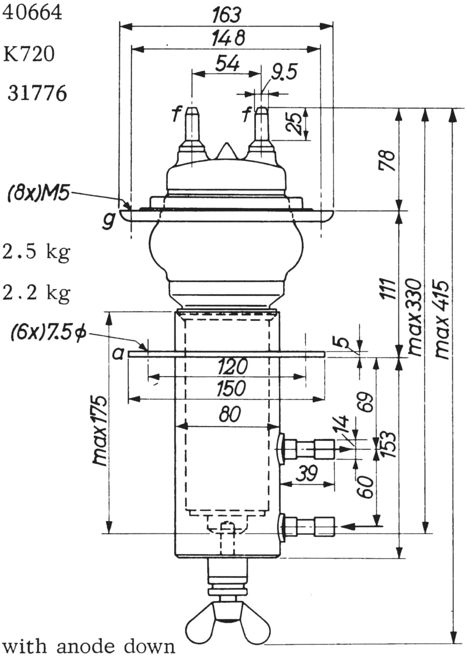
Dimensions in mm

Filament clips with cable : 40662

Grid connector : 40664

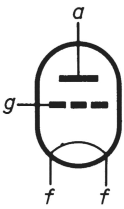
Water jacket : K720

O-ring : 2622 080 31776


163
148
54
9.5
f
f
25
78
(8x)M5
g
111
max330
max415
(6x)7.5ϕ
a
5
120
150
80
max175
14
69
153
39
60

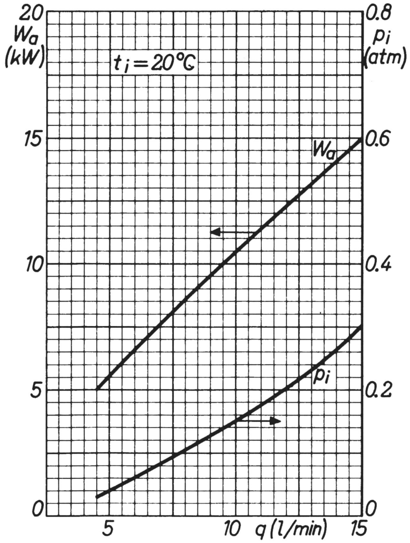
Net weight of tube : 2.5 kg

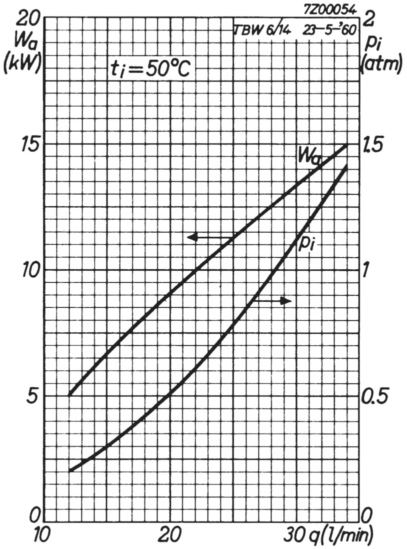
Net weight of water jacket: 2.2 kg



Mounting position: vertical with anode down

For further data and curves (except cooling curves) please refer to type TBH 6/14


20
Wa
(kW)
15
10
5
0
0.8
pi
(atm)
0.6
0.4
0.2
0
ti=20°C
Wa
pi
5
10
q (l/min)
15


7Z00054
TBW 6/14 23-5-'60
20
Wa
(kW)
15
10
5
0
2
pi
(atm)
1.5
1
0.5
0
ti=50°C
Wa
pi
10
20
30
q (l/min)

WATER COOLED R.F. POWER TRIODE

QUICK REFERENCE DATA

General purposes

λ (m)	Freq. (MHz)	C telegr.		B teleph.		C_a mod.		B mod. [1]	
		V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)
4	75	6	6.9	6	1.9			6	13.3
		5	5.6	5	1.45	5	4.7	5	6.6
		4	4			4.5	4.1	4.5	6.0
						4	3.5	4	5.3
						3.5	3	3.5	4.6
						3	2.2	3	3.3

Television service

Freq. (MHz)	Neg. mod. Pos. sync.			Pos. mod. Neg. sync.	
	V_a (kV)	W_o sync (kW)	W_o black (kW)	V_a (kV)	W_o white (kW)
75	5	9	5.35	5	9

HEATING: direct, filament thoriated tungsten

Filament voltage	V_f	=	12.6	V
Filament current	I_f	=	33	A

CAPACITANCES

Anode to all other elements except grid	C_a	=	0.3	pF
Grid to all other elements except anode	C_g	=	16	pF
Anode to grid	C_{ag}	=	11	pF

---

[1] Two tubes

7Z2 8686

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	4	kV
Anode current	I_a	=	1	A
Mutual conductance	S	=	17	mA/V
Amplification factor	μ	=	32	

COOLING: water/low-velocity air flow

WATER COOLING CHARACTERISTICS See also the cooling curves

W_a (kW)	t_i (^oC)	q_{min} 1) (l/min)	p_i (atm)
1	20	2.5	0.08
	50	3	0.1
2	20	2.5	0.08
	50	5	0.3
4	20	4	0.18
	50	9	0.9
6	20	6	0.4
	50	14	2.5

It is necessary to direct a low-velocity air flow to the anode and the grid seal at frequencies above 30 MHz
The air flow must be started upon or before application of the filament voltage

TEMPERATURE LIMITS (Absolute limits)

Water inlet temperature	t_i	=	max.	50	^oC
Temperature of seals	t	=	max.	180	^oC

---

1) At inlet temperatures between 20 and 50 ^oC the required quantity of water can be found by proportional interpolation

7Z2 8687

MECHANICAL DATA

Dimensions in mm

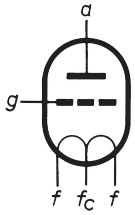
Filament connector: 40634

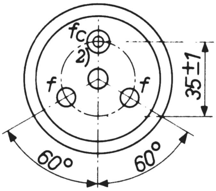
Grid connector : 40650[3]) or 40622

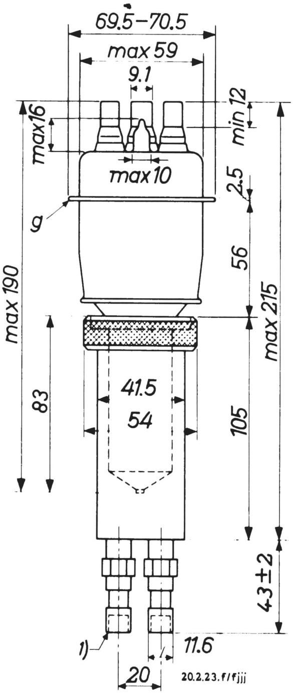
Net weight of tube : 0.45 kg

Net weight of K713 : 0.52 kg

→ O-ring : 3322 026 82801




f_c
2)
f
f
35±1
60°
60°


69.5–70.5
max 59
9.1
min 12
max16
max 10
2.5
g
56
max 190
max 215
83
41.5
54
105
43±2
1)
11.6
20
20.2.23.f/fjjj

Tube mounted in water jacket type K713

Mounting position: vertical with anode down

The centre tap f_c must not be used for filament current supply. The connectors type 40634, however, must be used for the cooling of all three filament pins, thus also of pin f_c

---

[1]) 1/8" pipe thread

[2]) This pin is marked "O"

[3]) The connector 40650 should be used only below 30 MHz
When the tube is used with this connector at maximum ratings additional cooling of the grid seal will be required

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

Frequency	f	up to	75	MHz
Anode voltage	V_a	= max.	6	kV
Negative grid voltage	$-V_g$	= max.	1000	V
Anode current	I_a	= max.	1.5	A
Grid current	I_g	= max.	0.35	A
Grid dissipation	W_g	= max.	120	W
Anode input power	W_{ia}	= max.	9	kW
Anode dissipation	W_a	= max.	6	kW

OPERATING CONDITIONS

Wavelength	λ	=	4	4	4	m
Frequency	f	=	75	75	75	MHz
Anode voltage	V_a	=	6	5	4	kV
Grid voltage	V_g	=	-400	-300	-200	V
Anode current	I_a	=	1.5	1.5	1.37	A
Grid current	I_g	=	0.31	0.33	0.35	A
Peak grid A.C. voltage	V_{gp}	=	740	640	500	V
Grid input power	W_{ig}	=	210	190	160	W
Anode input power	W_{ia}	=	9	7.5	5.5	kW
Anode dissipation	W_a	=	2.1	1.9	1.5	kW
Output power	W_o	=	6.9	5.6	4	kW
Efficiency	η	=	76.5	75	73	%

7Z2 8689

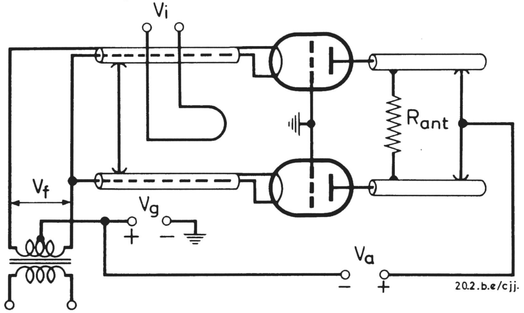
R.F. CLASS C TELEGRAPHY, grounded grid

LIMITING VALUES (Absolute limits)

Frequency	f		up to	75	MHz
Anode voltage	V_a	=	max.	6	kV
Positive cathode to grid voltage	V_{kg}	=	max.	1000	V
Anode current	I_a	=	max.	1.5	A
Grid current	I_g	=	max.	0.35	A
Grid dissipation	W_g	=	max.	120	W
Anode input power	W_{ia}	=	max.	9	kW
Anode dissipation	W_a	=	max.	6	kW

For frequencies from 75 MHz up to 220 MHz See page C

OPERATING CONDITIONS, two tubes



For data please refer to page 6

7Z2 8690

R.F. CLASS C TELEGRAPHY, grounded grid (continued)

OPERATING CONDITIONS, two tubes (continued)

λ	=	4	2.7 1)	2.7 1)	1.36 1)	m	
f	=	75	110	110	220	MHz	
V_a	=	6	5	4	4	kV	
V_g	=	−400	−300	−200	−200	V	
I_a	=	2x1.5	2x1.5	2x1.37	2x1.25	A	
I_g	=	2x0.31	2x0.33	2x0.35	2x0.2	A	
V_{g_p}	=	740	640	500	450	V	
W_{ig}	=	2x1120	2x920	2x675	2x380	W	
W_{ia}	=	2x9	2x7.5	2x5.5	2x5	kW	
W_a	=	2x2.1	2x2.2	2x1.7	2x2.5	kW	
W_o	=	13.8+1.82	10.6+1.46	7.6+1.03	5+0.6	kW	2)
η	=	76.5	71	69	50	%	3)

---

1) When using the tube above 108 MHz, particular attention must be paid to a careful design of the installation, otherwise the tube may be damaged. Therefore, our guarantee for the tubes operating at frequencies above 108 MHz can only be given after approval of the installation.

2) Power transferred from driving stage included.

3) Pure tube efficiency.

7Z2 8691

R.F. CLASS B TELEPHONY

LIMITING VALUES (Absolute limits)

Frequency	f	up to	75	MHz
Anode voltage	V_a	= max.	6	kV
Anode current	I_a	= max.	1.1	A
Anode input power	W_{ia}	= max.	6.6	kW
Anode dissipation	W_a	= max.	6	kW

OPERATING CONDITIONS

Wavelength	λ	=	4	4	m
Frequency	f	=	75	75	MHz
Anode voltage	V_a	=	6	5	kV
Grid voltage	V_g	=	-180	-145	V
Anode current	I_a	=	0.99	0.9	A
Peak grid A.C. voltage	V_{g_p}	=	250	225	V
Anode input power	W_{ia}	=	5.9	4.5	kW
Anode dissipation	W_a	=	4	3.05	kW
Output power	W_o	=	1.9	1.45	kW
Efficiency	η	=	32	32	%
Modulation factor	m	=	100	100	%
Grid current	I_g	=	0.3	0.32	A
Grid input power	W_{ig}	=	140	130	W

7Z2 8692

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

Frequency	f		up to	75	MHz
Anode voltage	V_a	=	max.	5	kV
Negative grid voltage	$-V_g$	=	max.	1000	V
Anode current	I_a	=	max.	1.3	A
Grid current	I_g	=	max.	0.35	A
Grid dissipation	W_g	=	max.	120	W
Anode input power	W_{ia}	=	max.	6.5	kW
Anode dissipation	W_a	=	max.	4	kW

OPERATING CONDITIONS

Wavelength	λ	=	4	4	4	4	4	m
Frequency	f	=	75	75	75	75	75	MHz
Anode voltage	V_a	=	5	4.5	4	3.5	3	kV
Grid voltage	V_g	=	-400	-350	-300	-300	-250	V [1]
Anode current	I_a	=	1.2	1.2	1.2	1.2	1	A
Grid current	I_g	=	0.3	0.3	0.3	0.3	0.3	A
Peak grid A.C. voltage	V_{g_p}	=	690	650	600	600	510	V
Grid input power	W_{ig}	=	190	180	165	165	140	W
Anode input power	W_{ia}	=	6	5.4	4.8	4.2	3	kW
Anode dissipation	W_a	=	1.3	1.3	1.3	1.2	0.8	kW
Output power	W_o	=	4.7	4.1	3.5	3.0	2.2	kW
Efficiency	η	=	78	76	73	71.5	73	%
Modulation fator	m	=	100	100	100	100	100	%
Modulation power	W_{mod}	=	3.0	2.7	2.4	2.1	1.5	kW

---

1) Grid bias partially obtained by the grid resistor

7Z2 8693

A.F. CLASS B AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	=	max.	6	kV
Anode current	I_a	=	max.	1.5	A
Anode input power	W_{ia}	=	max.	9	kW
Anode dissipation	W_a	=	max.	6	kW
Grid circuit resistance	R_g	=	max.	15	kΩ

OPERATING CONDITIONS, two tubes

V_a	=	6		5		4.5		kV
V_g	=	−165		−138		−125		V
$R_{aa\sim}$	=	4900		6400		6100		Ω
V_{ggp}	=	0	910	0	661	0	655	V
I_a	=	2x0.125	2x1.5	2x0.11	2x0.91	2x0.1	2x0.92	A
I_g	=	0	2x0.28	0	2x0.14	0	2x0.09	A
W_{ig}	=	0	2x115	0	2x42	0	2x27	W
W_{ia}	=	2x0.75	2x9	2x0.55	2x4.55	2x0.45	2x4.15	kW
W_a	=	2x0.75	2x2.35	2x0.55	2x1.25	2x0.45	2x1.15	kW
W_o	=	0	13.3	0	6.6	0	6	kW
d_{tot}	=	-	4.3	-	3.3	-	3.7	%
η	=	-	74	-	73	-	72	%

V_a	=	4		3.5		3		kV
V_g	=	−112		−100		−90		V
$R_{aa\sim}$	=	4900		4200		4400		Ω
V_{ggp}	=	0	632	0	618	0	570	V
I_a	=	2x0.1	2x0.94	2x0.075	2x0.95	2x0.065	2x0.8	A
I_g	=	0	2x0.19	0	2x0.18	0	2x0.2	A
W_{ig}	=	0	2x54	0	2x50	0	2x52	W
W_{ia}	=	2x0.4	2x3.75	2x0.26	2x3.3	2x0.2	2x2.4	kW
W_a	=	2x0.4	2x1.1	2x0.26	2x1	2x0.2	2x0.75	kW
W_o	=	0	5.3	0	4.6	0	3.3	kW
d_{tot}	=	-	2.6	-	2.9	-	3.3	%
η	=	-	71	-	70	-	69	%

7Z2 3509

GRID MODULATED R.F. CLASS C AMPLIFIER for television service; negative modulation, positive synchronisation (American and European system)

LIMITING VALUES (Absolute limits)

Frequency	f		up to 75	up to 220	MHz
Anode voltage	V_a		= max. 5	max. 4	kV
Anode input power	W_{ia}	sync	= max. 9.5	max. 6.5	kW
Anode dissipation	W_a	sync	= max. 5	max. 4	kW
Anode current	I_a	sync	= max. 1.9	max. 1.6	A
Grid dissipation	W_g	sync	= max. 120	max. 120	W
Negative grid voltage	$-V_g$		= max. 1000	max. 1000	V

OPERATING CONDITIONS, two tubes in push-pull

Frequency	f		= 48 to 75	170 to 220 1)	MHz
Bandwidth (−1.5 db)	B		= 5.25	6.5	MHz 2)
Bandwidth (−3 db)	B		= 8	10	MHz 2)
Anode voltage	V_a		= 5	4	kV
Grid voltage	V_g	sync	= −200	−150	V
		black	= −300	−225	V
		white	= −550	−500	V
Peak grid to grid voltage	V_{gg_p}	sync	= 1000	1000	V 3)
Anode current	I_a	sync	= 3.8	3.2	A
		black	= 2.8	2.6	A
Grid current	I_g	sync	= 0.5	0.4	A
		black	= 0.35	0.22	A
Grid input power	W_{ig}	sync	= 250	350 to 450	W 4)
Output power	W_o	sync	= 9	6	kW
		black	= 5.35	3.37	kW

---

1) When using the tube above 108 MHz, particular attention must be paid to a careful design of the installation, otherwise the tube may be damaged. Therefore, our guarantee for the tubes operating at frequencies above 108 MHz can only be given after approval of the installation

2) These values are based on measurements on a circuit with a single LC section

3) Measured by the slide back method

4) Driving power is accounted for largely by circuit losses. The indicated driving power is required to take care of losses in damping resistors, circuit losses and tube driving power

7Z2 8694

GRID MODULATED R.F. CLASS C AMPLIFIER for television service; positive modulation, negative synchronisation (BBC system)

LIMITING VALUES (Absolute limits)

Frequency	f			up to	75	MHz
Anode voltage	V_a		=	max.	5	kV
Negative grid voltage	$-V_g$		=	max.	1000	V
Anode current	I_a	white	=	max.	1.9	A
Anode input power	W_{ia}	white	=	max.	9.5	kW
Anode dissipation	W_a	white	=	max.	6	kW
Grid dissipation	W_g	white	=	max.	120	W

OPERATING CONDITIONS, two tubes in push-pull

Frequency	f		=	48-75	MHz
Bandwidth (I_{ant} = 85 %)	B		=	5.25	MHz
Bandwidth (I_{ant} = 70 %)	B		=	8	MHz
Anode voltage	V_a		=	5	kV
Grid voltage	V_g	white	=	-200	V
		black	=	-460	V
		sync	=	-580	V
Peak grid to grid voltage	V_{ggp}	white	=	1000	V
Anode current	I_a	white	=	3.8	A
		black	=	0.8	A
Grid current	I_g	white	=	0.5	A
		black	=	0	A
Grid input power	W_{ig}	white	=	250	W
Output power	W_o	white	=	9	kW
		black	=	0.6	kW

7Z2 8695

R.F. CLASS B TELEPHONY for television service (American and European system

LIMITING VALUES (Absolute limits)

Frequency	f			up to 75	up to 220	MHz
Anode voltage	V_a		=	max. 5	max. 4	kV
Anode input power	W_{ia}	sync	=	max. 9.5	max. 6.5	kW
Anode dissipation	W_a	sync	=	max. 5	max. 4	kW
Anode current	I_a	sync	=	max. 1.9	max. 1.6	A
Grid dissipation	W_g	sync	=	max. 120	max. 120	W

OPERATING CONDITIONS, two tubes in push-pull

Frequency	f		=	48 to 75	170 to 220[1]	MHz
Bandwidth (−1.5 db)	B		=	5.25	6.5	MHz [2]
Bandwidth (−3 db)	B		=	8	10	MHz [2]
Anode voltage	V_a		=	5	4	kV
Grid voltage	V_g		=	−200	−150	V
Peak grid to grid voltage	V_{ggp}	sync	=	1000	1000	V [3]
		black	=	800	750	V [3]
		white	=	0	200	V [3]
Anode current	I_a	sync	=	3.8	3.2	A
		black	=	3	2.6	A
		white	=	0.2	-	A
Grid current	I_g	sync	=	0.5	0.4	A
		black	=	0.22	0.22	A
		white	=	0	-	A
Grid input power	W_{ig}	sync	=	250	350 to 450	W [4]
Output power	W_o	sync	=	9	6	kW
		black	=	5.35	3.37	kW

---

[1] When using the tube above 108 MHz, particular attention must be paid to a careful design of the installation, otherwise the tube may be damaged Therefore, our guarantee for the tubes operating at frequencies above 108 MHz can only be given after approval of the installation

[2] These values are based on measurements on a circuit with a single LC section

[3] Measured by the slide back method

[4] Driving power is accounted for largely by circuit losses. The indicated driving power is required to take care of losses in damping resistors, circuit losses and tube driving power

7Z2 8696

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from two-phase half-wave rectifier without filter

LIMITING VALUES (Absolute limits)

Frequency	f		up to	75	MHz
Anode voltage	V_a	=	max.	5400	V
Negative grid voltage	$-V_g$	=	max.	900	V
Anode current	I_a	=	max.	1.35	A
Grid current	I_g	=	max.	0.31	A
Anode input power	W_{ia}	=	max.	9	kW
Anode dissipation	W_a	=	max.	6	kW
Grid dissipation	W_g	=	max.	120	W

OPERATING CONDITIONS

Transformer voltage	V_{tr}	=	6.0 1)	5.1 2)	kV_{RMS}
Anode voltage	V_a	=	5.4	4.6	kV 3)
Anode current	I_a	=	1.35	1.15	A
Grid current	I_g	=	0.31	0.27	A
Grid resistor	R_g	=	1300	1100	Ω
Grid input power	W_{ig}	=	210	160	W
Anode input power	W_{ia}	=	9	6.5	kW
Anode dissipation	W_a	=	2.3	1.84	kW
Output power	W_o	=	6.5	4.5	kW
Efficiency	η	=	72	70	%

---

1) Care must be taken that under these operating conditions the absolute limiting values are not exceeded by variation of the supply voltage or the load or by tolerances in the circuit elements

2) Under these conditions normal deviations of voltages and load are permissible. The absolute limiting values of the tube must, however, not be exceeded

3) D.C. value

7Z2 8697

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from three-phase half-wave rectifier without filter

LIMITING VALUES (Absolute limits)

Frequency	f		up to	75	MHz
Anode voltage	V_a	=	max.	6000	V
Negative grid voltage	$-V_g$	=	max.	1000	V
Anode current	I_a	=	max.	1.5	A
Grid current	I_g	=	max.	0.35	A
Anode input power	W_{ia}	=	max.	9	kW
Anode dissipation	W_a	=	max.	6	kW
Grid dissipation	W_g	=	max.	120	W

OPERATING CONDITIONS

Frequency	f	=	75	75	MHz
Transformer voltage	V_{tr}	=	5.1[1]	4.4[2]	kV_{RMS}
Anode voltage	V_a	=	6.0	5.1	kV[3]
Anode current	I_a	=	1.5	1.25	A
Grid current	I_g	=	0.31	0.28	A
Grid resistor	R_g	=	1300	1100	Ω
Grid input power	W_{ig}	=	210	160	W
Anode input power	W_{ia}	=	9	6.4	kW
Anode dissipation	W_a	=	1.9	1.74	kW
Output power	W_o	=	6.9	4.5	kW
Efficiency	η	=	76.5	70	%

---

[1] Care must be taken that under these operating conditions the absolute limiting values are not exceeded by variation of the supply voltage or the load or by tolerances in the circuit elements

[2] Under these conditions normal deviations of voltages and load are permissible. The absolute limiting values of the tube must, however, not be exceeded

[3] D.C. value

7Z2 8698

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with self rectification

LIMITING VALUES (Absolute limits)

Frequency	f	up to	75	MHz
Transformer voltage	V_{tr}	= max.	6800	V_{RMS}
Negative grid voltage	$-V_g$	= max.	640	V
Anode current	I_a	= max.	0.8	A
Grid current	I_g	= max.	0.19	A
Anode input power	W_{ia}	= max.	9	kW
Anode dissipation	W_a	= max.	6	kW
Grid dissipation	W_g	= max.	120	W

OPERATING CONDITIONS

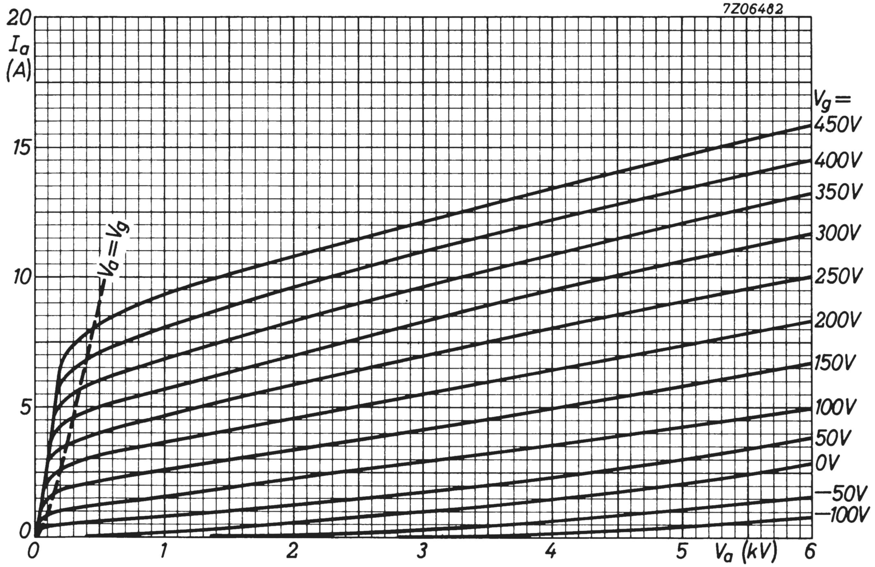
Frequency	f	=	75	75	MHz
Transformer voltage	V_{tr}	=	6.8(1)	5.9(2)	kV_{RMS}
Anode current	I_a	=	0.8	0.7	A
Grid current	I_g	=	0.19	0.165	A
Grid resistor	R_g	=	1050	1050	
Grid input power	W_{ig}	=			W
Anode input power	W_{ia}	=	6.05	4.6	kW
Anode dissipation	W_a	=	1.5	1.24	kW
Output power	W_o	=	4.55	3.36	kW
Efficiency	η	=	75	73	%

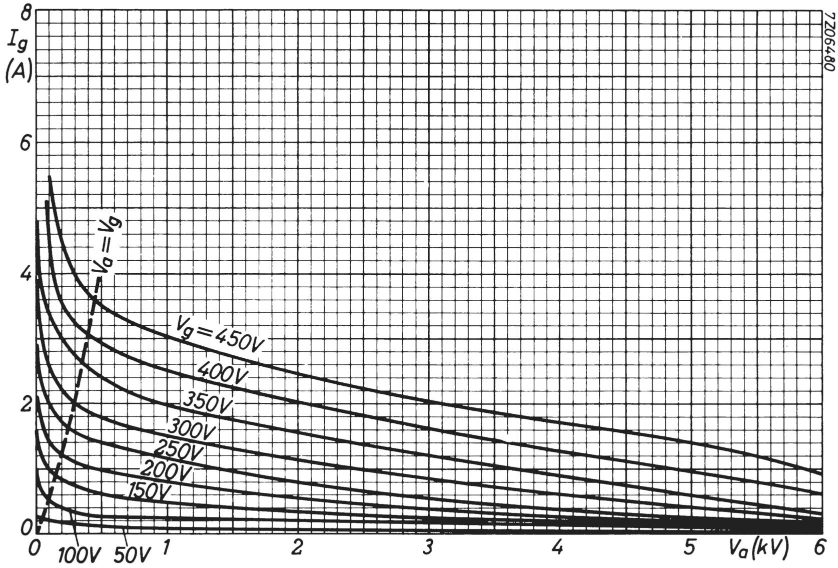
---

(1) Care must be taken that under these operating conditions the absolute limiting values are not exceeded by variation of the supply voltage or the load or by tolerances in the circuit elements

(2) Under these conditions normal deviations of voltages and load are permissible. The absolute limiting values of the tube must, however, not be exceeded

7Z2 8699


7Z06482
20
I_a
(A)
15
10
5
0
0
1
2
3
4
5
V_a (kV)
6
$V_a = V_g$
$V_g =$
450V
400V
350V
300V
250V
200V
150V
100V
50V
0V
−50V
−100V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I_g
(A)
6
4
2
0
0
1
2
3
4
5
V_a(kV)
6
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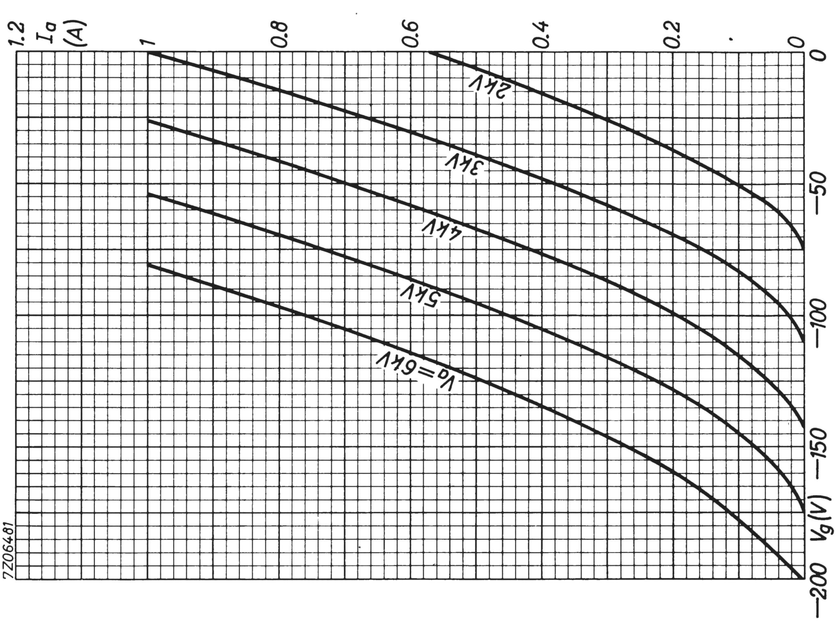
$V_g = 450V$
400V
350V
300V
250V
200V
150V
100V
50V


1.2
I_a
(A)
1
0.8
0.6
0.4
0.2
0
0
—50
—100
—150
V_g(V)
—200
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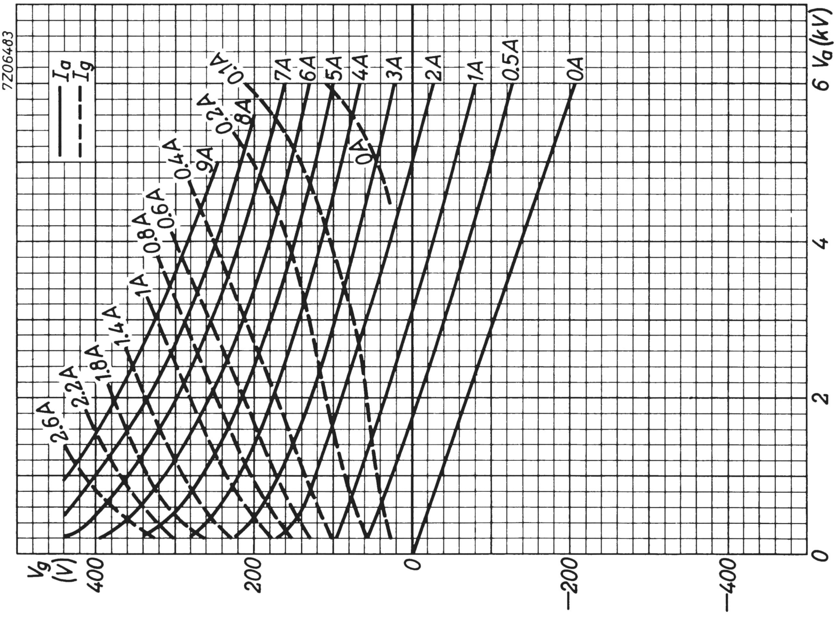
5kV
4kV
3kV
2kV
7Z06481


7Z06483
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I_g
V_g
(V)
400
200
0
—200
—400
0
2
4
6 V_a(kV)
2.6A
2.2A
1.8A
1.4A
1A
0.8A
0.6A
0.4A
0.2A
0.1A
0A
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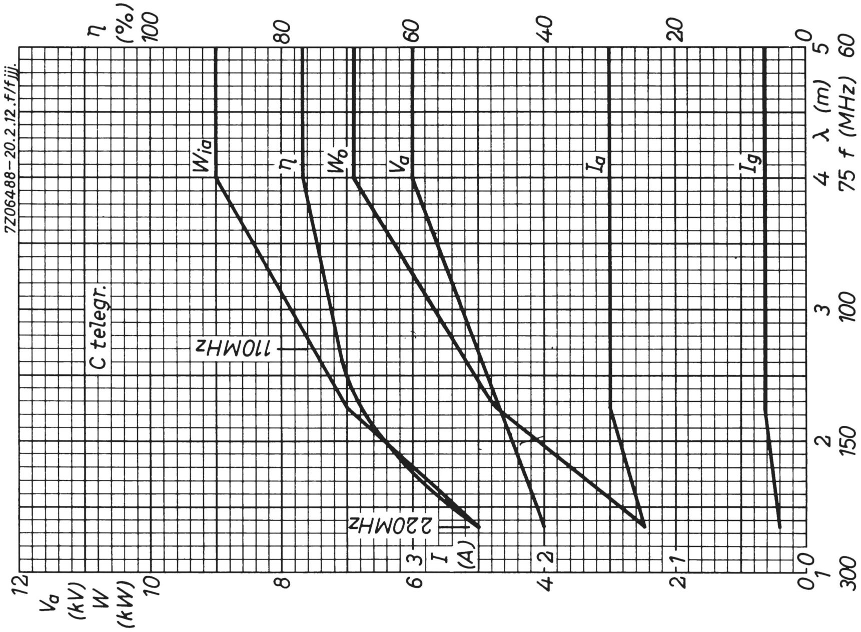
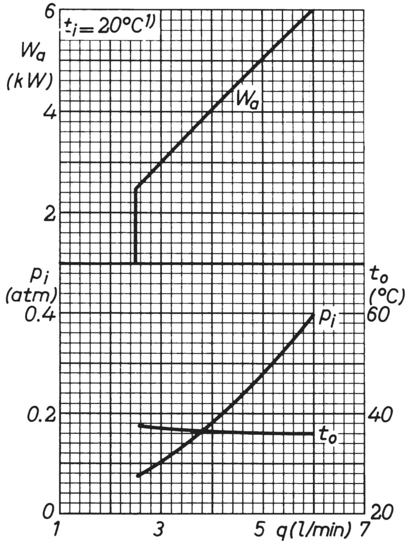
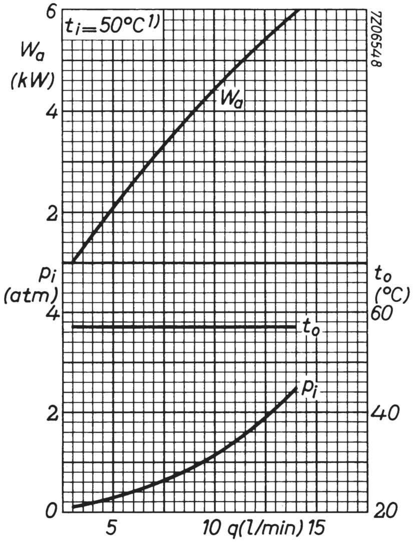
8A
7A
6A
5A
4A
3A
2A
1A
0.5A
0A


7Z06488-20.2.12.f/fjjj.
C telegr.
W_{ia}
η
W_o
V_a
I_a
I_g
110MHz
220MHz
η (%)
100
80
60
40
20
0
V_a (kV)
W (kW)
12
10
8
6
4
2
0
I (A)
3
2
1
0
λ (m)
5
4
3
2
1
f (MHz)
60
75
100
150
300


$t_i = 20°C$ 1)
W_a (kW)
6
4
2
W_a
p_i (atm)
0.4
0.2
0
t_o (°C)
60
40
20
p_i
t_o
1
3
5
q (l/min)
7


7Z06548
$t_i = 50°C$ 1)
W_a (kW)
6
4
2
W_a
p_i (atm)
4
2
0
t_o (°C)
60
40
20
t_o
p_i
5
10
q (l/min)
15

WATER COOLED R.F. POWER TRIODE

QUICK REFERENCE DATA							
λ (m)	Freq. (MHz)	C telegr.		C osc.		B mod. 1)	
		V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)
10	30	6.5	9.5			7.0	20
		6.0	8.5			5.0	9.0
		5.0	7.1			4.0	7.1
6	50			6.0	6.0		

COOLING: water/low-velocity air flow

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	12.6	V
Filament current	I_f	=	33	A

CAPACITANCES

Anode to all other elements except grid	C_a	=	0.3	pF
Grid to all other elements except anode	C_g	=	16	pF
Anode to grid	C_{ag}	=	11	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	6	kV
Anode current	I_a	=	1	A
Amplification factor	μ	=	32	
Mutual conductance	S	=	15	mA/V

---

1) Two tubes

WATER COOLING CHARACTERISTICS , see also the cooling curves

W_a (kW)	t_i (^oC)	q_{min} [1] (l/min)	p_i (atm)
1	20	2.5	0.08
	50	3	0.1
2	20	2.5	0.08
	50	5	0.3
4	20	4	0.18
	50	9	0.9
6	20	6	0.4
	50	14	2.5

TEMPERATURE LIMITS (Absolute limits)

Inlet temperature	t_i	= max.	50	°C
Temperature of filament seals		= max.	210	°C
Temperature of grid and anode seals		= max.	180	°C

ACCESSORIES

Filament connectors	40634
Connector centre pin of filament	40649 ²)
Grid connector	40650 ³) or 40622
Water jacket	K713

In general, no air cooling will be required at frequencies up to 30 MHz and at ambient temperatures below 35 °C.
At higher frequencies or at higher ambient temperatures a low-velocity air flow to the grid and filament seals will be necessary.

---

¹) At water inlet temperatures between 20 and 50 °C the required quantity of water can be found by proportional interpolation

2) The centre tap f_c (diameter 10.5 mm; marked O) must not be used for filament current supply. The connector type 40649, however, must be used for the cooling of this pin

³) See page 3. The connector 40650 should only be used below 30 MHz

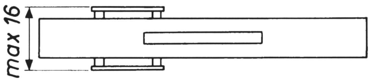
7Z2 8700

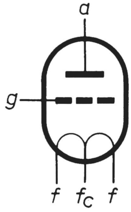
MECHANICAL DATA

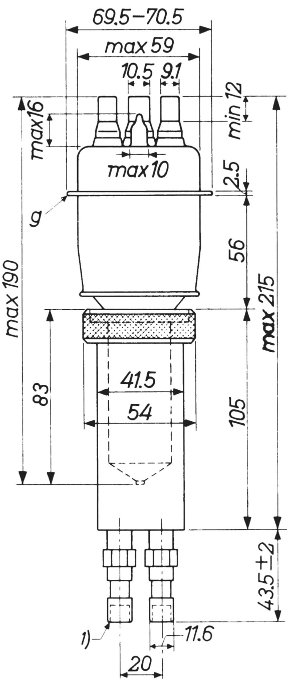
Dimensions in mm

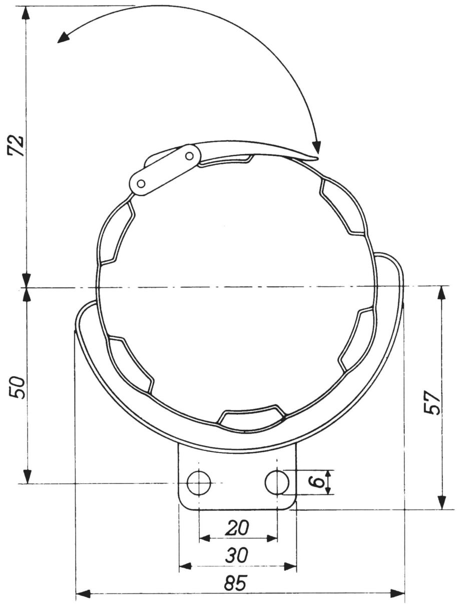
Net weight of the tube : 0.45 kg

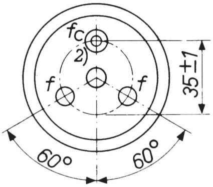
Net weight of water-jacket: 0.52 kg






69.5–70.5
max 59
10.5
9.1
min 12
max16
max 10
2.5
g
56
max 190
max 215
41.5
54
83
105
43.5±2
1)
11.6
20


72
50
57
6
20
30
85


f_c
2)
f
f
35±1
60°
60°

Grid connector
40650

O-ring : 3322 026 82801

Mounting position: vertical with anode down

---

1) 1/8" pipe thread

2) The centre tap f_c (diameter 10.5 mm; marked O) must not be used for filament current supply. The connector type 40649, however, must be used for the cooling of this pin

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

Frequency	f		up to	30	MHz
Anode voltage	V_a	=	max.	7.2	kV
Negative grid voltage	$-V_g$	=	max.	1250	V
Anode current	I_a	=	max.	2.2	A
Grid current	I_g	=	max.	0.6	A
Anode input power	W_{ia}	=	max.	14	kW
Anode dissipation	W_a	=	max.	6	kW

OPERATING CONDITIONS

Wavelength	λ	=	10	10	10	m
Frequency	f	=	30	30	30	MHz
Anode voltage	V_a	=	6.5	6.0	5.0	kV
Grid voltage	V_g	=	-450	-400	-300	V
Anode current	I_a	=	2.0	2.0	2.0	A
Grid current	I_g	=	0.5	0.5	0.5	A
Peak grid A.C. voltage	V_{gp}	=	820	780	660	V
Grid input power	W_{ig}	=	370	350	297	W
Anode input power	W_{ia}	=	13	12	10	kW
Anode dissipation	W_a	=	3.5	3.5	2.9	kW
Output power	W_o	=	9.5	8.5	7.1	kW
Efficiency	η	=	73	71	71	%

A.F. CLASS B AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	=	max.	7.2	kV
Anode current	I_a	=	max.	2.2	A
Anode input power	W_{ia}	=	max.	14	kW
Anode dissipation	W_a	=	max.	6	kW
Grid circuit resistance	R_g	=	max.	15	kΩ

OPERATING CONDITIONS, two tubes

V_a	=	7		5		5		4		kV
V_g	=	−250		−165		−165		−135		V
$R_{aa\sim}$	=	4150		4800		5500		3800		Ω
V_{gg_p}	=	0	1300	0	880	0	730	0	930	V
I_a	=	2x0.2	2x2.0	2x0.15	2x1.25	2x0.15	2x1.1	2x0.1	2x1.25	A
I_g	=	0	2x0.53	0	2x0.33	0	2x0.22	0	2x0.36	A
I_{g_p}	=	–	2x2.8	–	2x1.75	–	2x1.2	–	2x1.8	A
W_{ig}	=	0	2x310	0	2x130	0	2x70	0	2x135	W
W_{ia}	=	2x1.4	2x14	2x0.75	2x6.2	2x0.75	2x5.5	2x0.4	2x5.0	kW
W_a	=	2x1.4	2x4.0	2x0.75	2x1.7	2x0.75	2x1.5	2x0.4	2x1.45	kW
W_o	=	0	20	0	9	0	8.0	0	7.1	kW
η	=	–	71.5	–	72.5	–	72.5	–	71	%

7Z2 3522

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from three-phase half-wave rectifier without filter

LIMITING VALUES (Absolute limits)

Frequency	f		up to	55	MHz
Anode voltage	V_a	=	max.	7	kV
Negative grid voltage	$-V_g$	=	max.	1250	V
Anode current	I_a	=	max.	1.8	A
Grid current	I_g	=	max.	0.5	A [1]
Anode input power	W_{ia}	=	max.	11	kW
Anode dissipation	W_a	=	max.	6	kW
Grid circuit resistance	R_g	=	max.	10	kΩ

OPERATING CONDITIONS

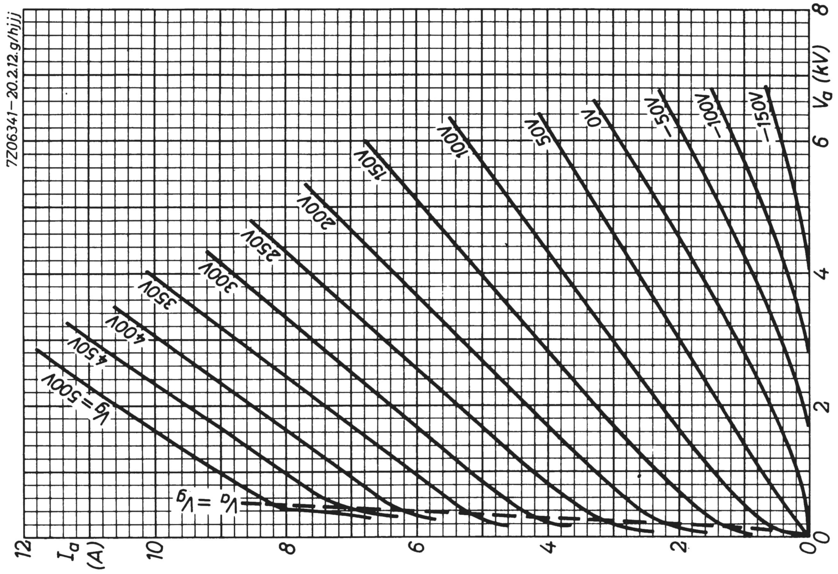
Frequency	f	=	50	MHz
Transformer voltage	V_{tr}	=	5100	V_{RMS}
Anode voltage	V_a	=	6.0	kV
Anode current	I_a	=	1.5	A
Grid current	I_g	=	0.4	A [1]
Grid resistor	R_g	=	1000	Ω
Grid input power	W_{ig}	=	300	W
Anode input power	W_{ia}	=	9	kW
Anode dissipation	W_a	=	2.7	kW
Output power	W_o	=	6	kW [2]
Efficiency	η	=	67	%

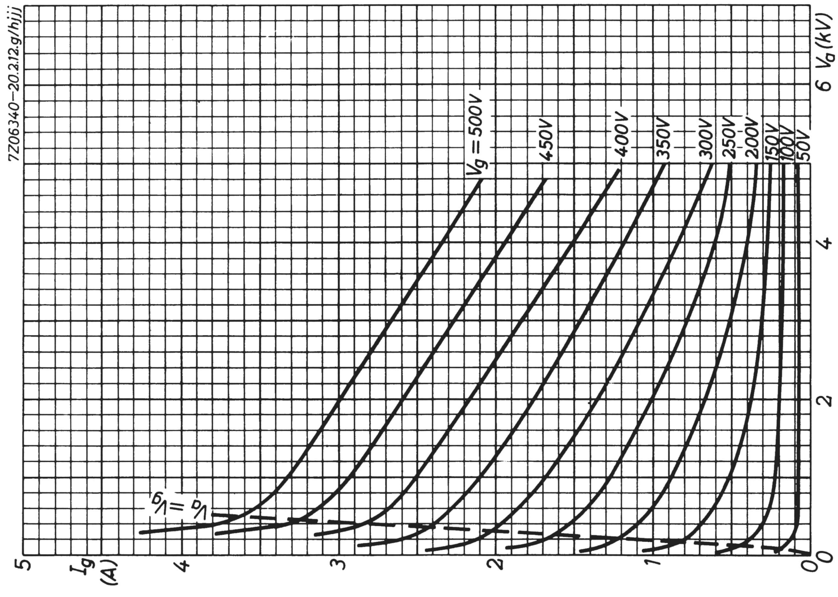
---

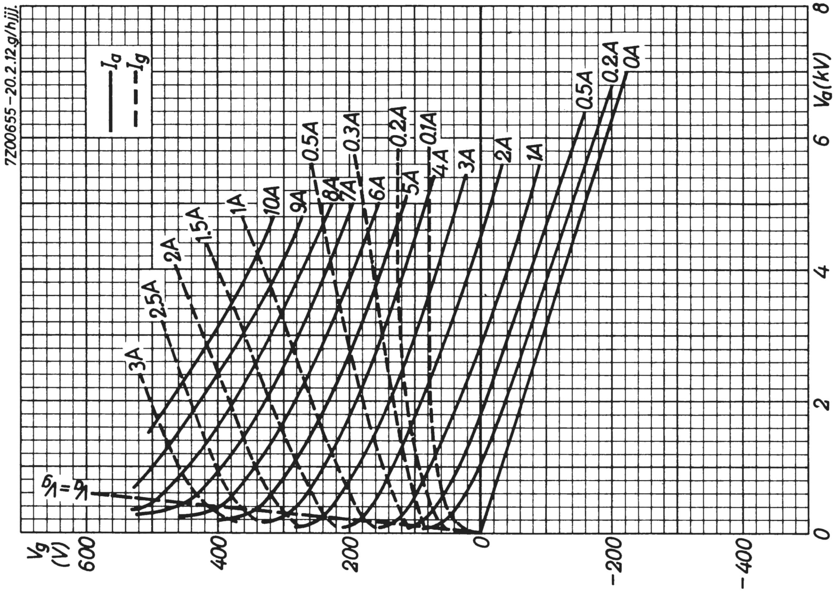
[1] Unloaded 0.7 A

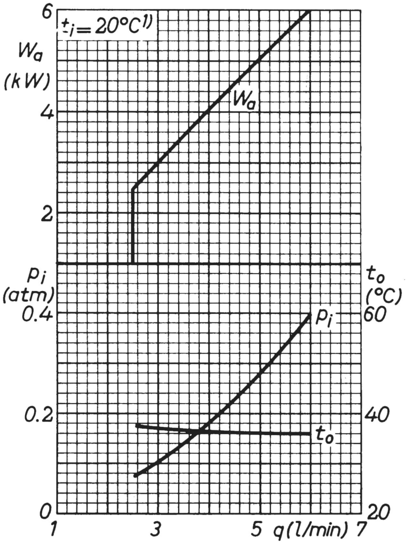
[2] Available power (load + circuit losses)

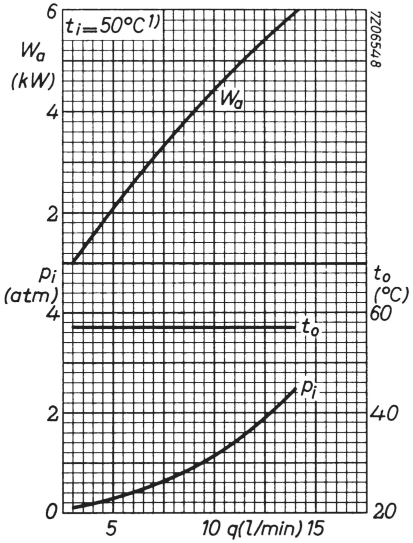
7Z2 3523


7Z06341-20.2.12.g/hjjj
I_a (A)
12
10
8
6
4
2
0
V_a (kV)
0
2
4
6
8
V_g = 500V
450V
400V
350V
300V
250V
200V
150V
100V
50V
0V
−50V
−100V
−150V
$V_a = V_g$


7Z06340-20.2.12.g/hjjj
I_g (A)
5
4
3
2
1
0
V_a (kV)
0
2
4
6
V_g = 500V
450V
400V
350V
300V
250V
200V
150V
100V
50V
$V_a = V_g$


7Z00655-20.2.12.g/hjjj.
I_a
I_g
V_a(kV)
8
6
4
2
0
V_g (V)
600
400
200
0
−200
−400
$V_a = V_g$
3A
2.5A
2A
1.5A
1A
0.5A
0.3A
0.2A
0.1A
10A
9A
8A
7A
6A
5A
4A
3A
2A
1A
0.5A
0.2A
0A


$t_i = 20°C$ 1)
W_a (kW)
6
4
2
W_a
p_i (atm)
0.4
0.2
0
t_o (°C)
60
40
20
p_i
t_o
1
3
5
q(l/min)
7


$t_i = 50°C$ 1)
7Z06548
W_a (kW)
6
4
2
W_a
p_i (atm)
4
2
0
t_o (°C)
60
40
20
t_o
p_i
5
10
q(l/min)
15

WATER COOLED
INDUSTRIAL R.F. POWER TRIODE

QUICK REFERENCE DATA		
Industrial R.F. oscillator class C		
Freq.	Three phase	
(MHz)	V_a (kV)	W_ℓ [1] (kW)
50	7.2 6.2	6.1 5.0

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	12.6	V	+5 % -10 %
Filament current	I_f	=	32	A	

CAPACITANCES

Anode to all other elements except grid	C_a	=	0.4	pF
Grid to all other elements except anode	C_g	=	13.5	pF
Anode to grid	C_{ag}	=	7.4	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	6	kV
Anode current	I_a	=	1	A
Mutual conductance	S	=	12	mA/V
Amplification factor	μ	=	24	

---

[1] Useful power in the load

TEMPERATURE LIMITS (Absolute limits)

Water inlet temperature t_i = max. 50 °C

Temperature of the seals = max. 220 °C

WATER COOLING CHARACTERISTICS

W_a (kW)	t_i (°C)	q_{min} (l/min)	p_i (atm)
2	20	2.5	0.06
	50	5	0.2
4	20	4	0.14
	50	9	0.7
6	20	6	0.3
	50	14	1.9

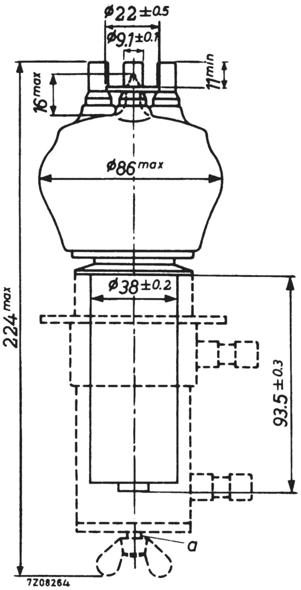
At water inlet temperatures between 20 and 50 °C the required quantity of water can be found by proportional interpolation.

At frequencies above 4 MHz both grid terminals should be connected in parallel. At the highest frequencies care should be taken to distribute the R.F. current equally over both grid terminals to avoid excessive grid seal temperatures.

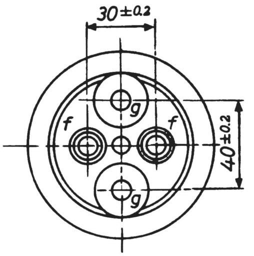
MECHANICAL DATA

Dimensions in mm

Net weight of the tube	0.57	kg
Net weight of water-jacket :	0.76	kg


ø22±0.5
ø9.1±0.1
11min
16max
ø86max
ø38±0.2
224max
93.5±0.3
a
7Z08264

Grid and filament connectors	40634
Water jacket	K721
→ O-ring	2622 080 31748


30±0.2
g
f
f
40±0.2
g

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from three-phase rectifier without filter

LIMITING VALUES (Absolute limits), continuous service

Frequency	f		up to	50	MHz
Anode voltage	V_a	=	max.	8	kV
Anode input power	W_{ia}	=	max.	12	kW
Anode dissipation	W_a	=	max.	6	kW
Anode current	I_a	=	max.	1.8	A
Negative grid voltage	$-V_g$	=	max.	1250	V
Grid current, loaded	I_g	=	max.	0.4	A
Grid current, unloaded	I_g	=	max.	0.5	A
Grid circuit resistance	R_g	=	max.	10	kΩ

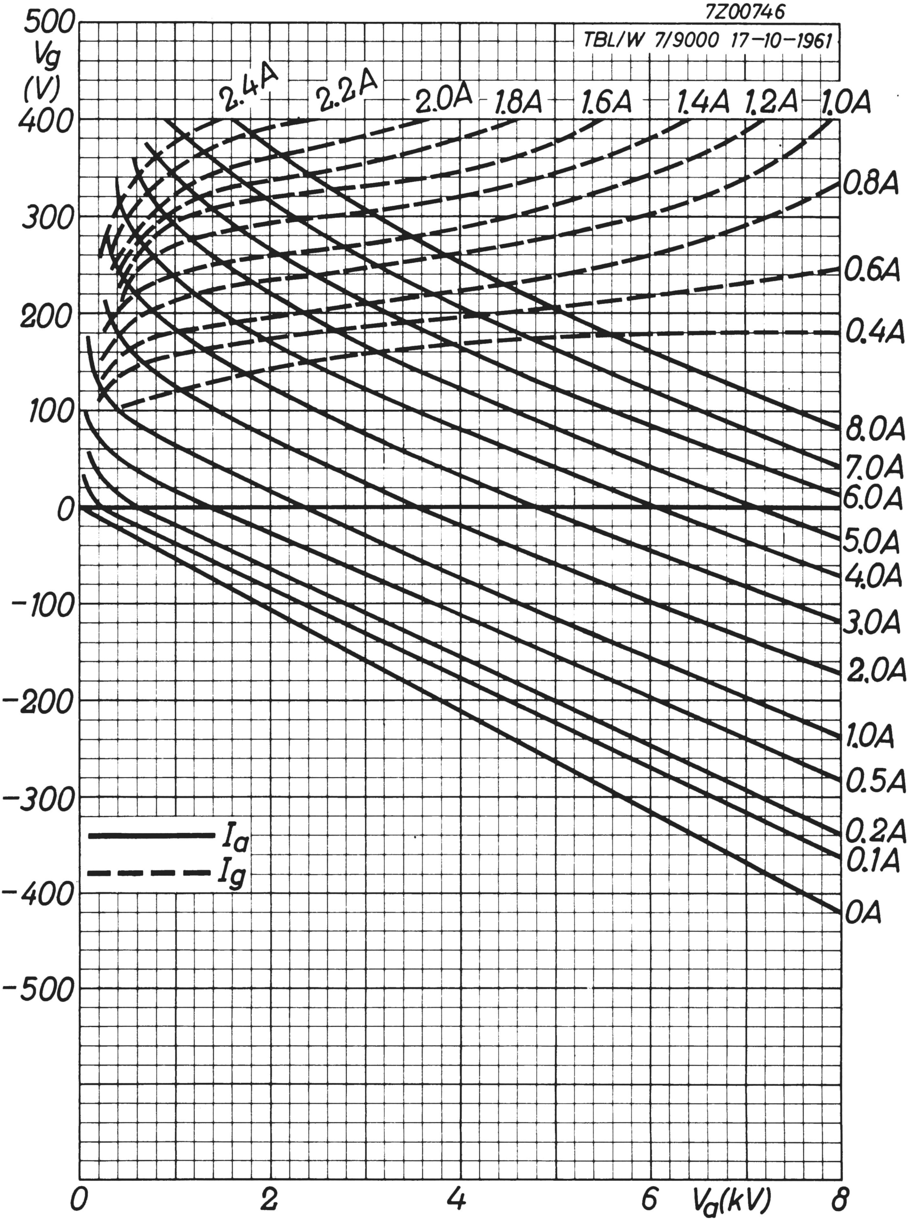
OPERATING CHARACTERISTICS , continuous service

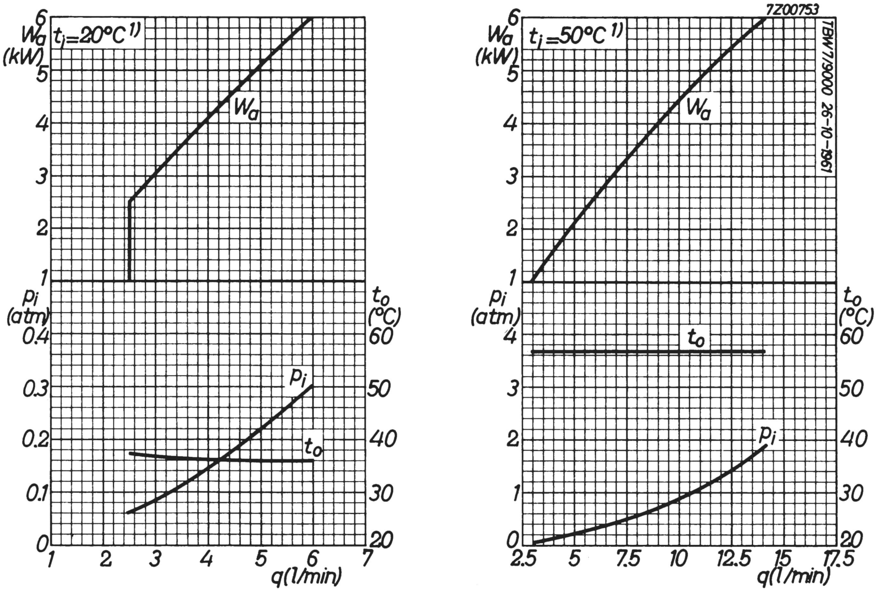
Frequency	f	=	50	50	MHz
Anode voltage	V_a	=	7200	6200	V
Anode current, loaded	I_a	=	1.5	1.4	A
Anode current, unloaded	I_a	=	0.37	0.40	A
Grid current, loaded	I_g	=	0.36	0.37	A
Grid current, unloaded	I_g	=	0.47	0.47	A
Grid resistor	R_g	=	1850	1500	Ω
Load resistance	$R_{a\sim}$	=	2300	2100	Ω
Feedback ratio under loaded conditions	$V_{g\sim}/V_{a\sim}$	=	17	17	%
Anode input power	W_{ia}	=	10.8	8.68	kW
Anode dissipation	W_a	=	3.3	2.5	kW
Efficiency	η	=	70	71	%
Output power in the load	W_ℓ	=	6.1	5.0	kW 1)

---

1) Useful power in the load, measured in a circuit having an efficiency of 85 %

7Z2 3540


7Z00746
TBL/W 7/9000 17-10-1961
500
Vg
(V)
400
300
200
100
0
-100
-200
-300
-400
-500
2.4A
2.2A
2.0A
1.8A
1.6A
1.4A
1.2A
1.0A
0.8A
0.6A
0.4A
8.0A
7.0A
6.0A
5.0A
4.0A
3.0A
2.0A
1.0A
0.5A
0.2A
0.1A
0A
Ia
Ig
0
2
4
6
Va(kV)
8


Wa (kW)
tᵢ=20°C 1)
Wa
pᵢ (atm)
tₒ (°C)
pᵢ
tₒ
0 0.1 0.2 0.3 0.4
1 2 3 4 5 6
20 30 40 50 60
1 2 3 4 5 6 7
q(l/min)
7Z00753
TBW7/9000 26-10-1961
Wa (kW)
tᵢ=50°C 1)
Wa
pᵢ (atm)
tₒ (°C)
tₒ
pᵢ
0 1 2 3 4
1 2 3 4 5 6
20 30 40 50 60
2.5 5 7.5 10 12.5 15 17.5
q(l/min)

WATER COOLED
INDUSTRIAL R.F. POWER TRIODE

QUICK REFERENCE DATA		
Industrial R.F. oscillator class C		
Freq. (MHz)	Three phase	
	V_a (kV)	W_o (kW)
30	12 10 8	29.0 23.3 17.9

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	8.0	V	+ 5 % -10 %
Filament current	I_f	=	98	A	
Cold filament resistance	R_{fo}	=	0.008	Ω	

The filament current must never exceed a peak value of 210 A instantaneously at any time during the initial energizing schedule

CAPACITANCES

Anode to all other elements except grid	C_a	=	0.4	pF
Grid to all other elements except anode	C_g	=	37	pF
Anode to grid	C_{ag}	=	30	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	12	kV
Anode current	I_a	=	2	A
Amplification factor	μ	=	34	
Mutual conductance	S	=	20	mA/V

TEMPERATURE LIMIT (Absolute limit)

Seal temperature = max. 220 °C

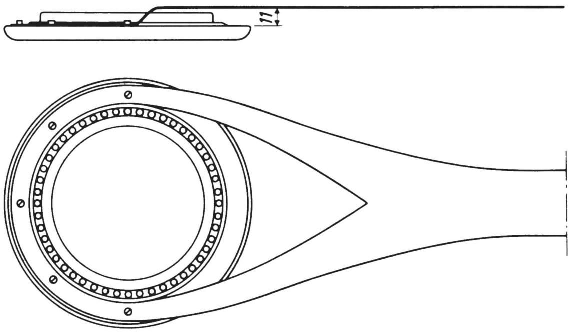
Generally a low velocity air flow to the seals is required

WATER COOLING CHARACTERISTICS

t_i = max. 50 °C

W_a (kW)	t_i (°C)	q_{min}[1] (l/min)	p_i (atm.)
5	20	6	0.02
	50	15	0.22
10	20	11	0.1
	50	25	0.7
15	20	16	0.25
	50	37	1.3
20	20	22	0.5
	50	49	2.3

To ensure a uniform R.F. current distribution in the grid seal especially at frequencies higher than 4 MHz, the grid lead should be connected as shown below.



---

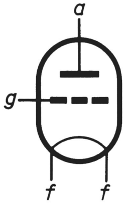
[1] At inlet temperatures between 20 and 50 °C the required quantity of water can be found by proportional interpolation

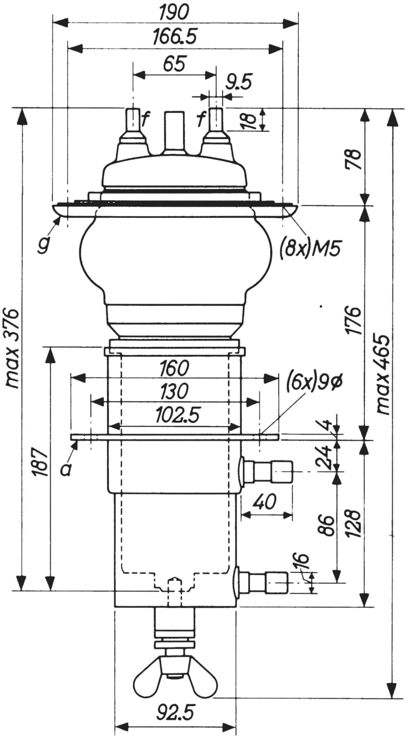
7Z2 3552

MECHANICAL DATA

Dimensions in mm

Net weight of the tube	: 2.8 kg
Net weight of water jacket	: 2.1 kg
Filament connectors with cable	: 40662
Grid connector	: 40663
Water jacket	: K717
O-ring	: 2622 080 31788




190
166.5
65
9.5
f
f
18
78
g
(8x)M5
max 376
176
max 465
160
130
102.5
(6x)9ø
4
24
187
a
40
86
128
16
92.5

Tube with grid connector
and water jacket

Mounting position: vertical with anode down

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from three-phase half-wave rectifier without filter

LIMITING VALUES (Absolute limits)

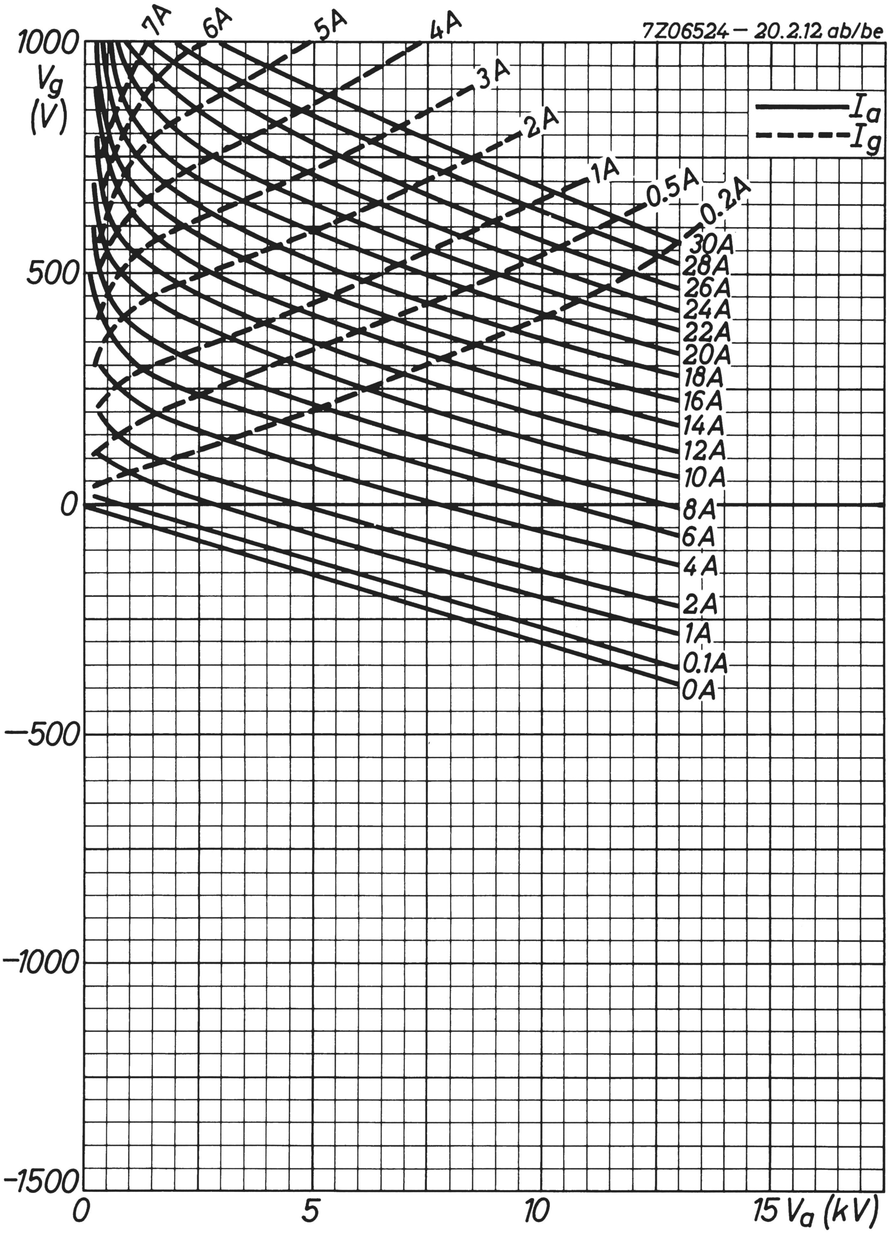
Frequency	f		up to	30	MHz
Anode voltage	V_a	=	max.	13	kV
Anode current	I_a	=	max.	4.8	A
Anode dissipation	W_a	=	max.	20	kW
Anode input power	W_{ia}	=	max.	60	kW
Negative grid voltage	$-V_g$	=	max.	1500	V
Grid current	I_g	=	max.	0.8	A
Grid circuit resistance	R_g	=	max.	10	kΩ

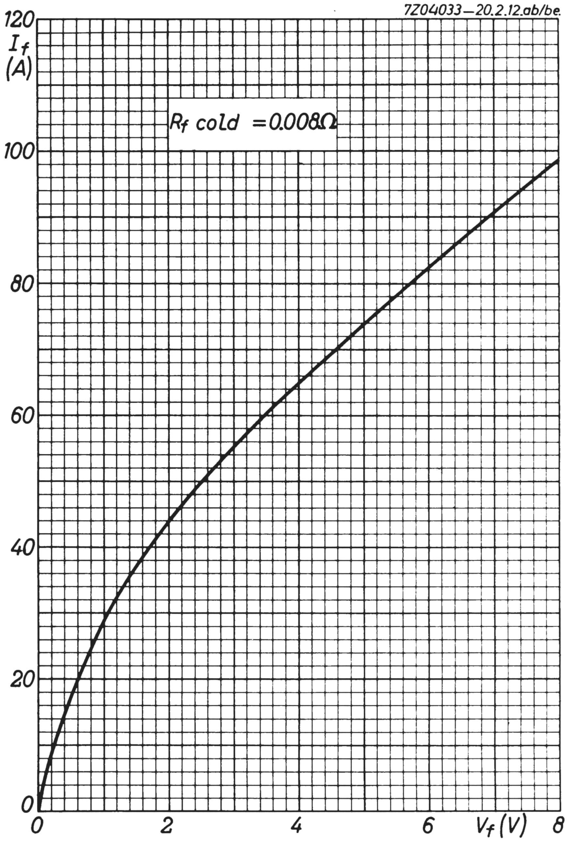
OPERATING CONDITIONS

Frequency	f	=	30	30	30	MHz
Transformer voltage	V_{tr}	=	8.9	7.4	6.0	kV
Anode voltage	V_a	=	12	10	8	kV
Anode current, loaded	I_a	=	3.2	3.2	3.2	A
Anode current, unloaded	I_a	=	0.52	0.50	0.48	A
Grid current, loaded	I_g	=	0.50	0.50	0.50	A
Grid current, unloaded	I_g	=	0.74	0.77	0.80	A
Grid resistor	R_g	=	2.0	1.6	1.1	kΩ
Load resistance	$R_{a\sim}$	=	1800	1450	1100	Ω
Feedback ratio under loaded conditions	$V_{g\sim}/V_{a\sim}$	=	16	17	19	%
Anode input power	W_{ia}	=	38.4	32.0	25.6	kW
Anode dissipation	W_a	=	9.4	8.7	7.7	kW
Output power	W_o	=	29.0	23.3	17.9	kW
Efficiency	η	=	75.5	72.5	70	%
Output power in the load	W_{ℓ}	=	25	20	15.5	kW[1]

---

[1] Useful power in the load measured in a circuit having an efficiency of 90%


7Z06524 – 20.2.12 ab/be
1000
V_g
(V)
500
0
−500
−1000
−1500
0
5
10
15 V_a (kV)
I_a
I_g
7A
6A
5A
4A
3A
2A
1A
0.5A
0.2A
30A
28A
26A
24A
22A
20A
18A
16A
14A
12A
10A
8A
6A
4A
2A
1A
0.1A
0A


7Z04033—20.2.12.ab/be.
120
I_f
(A)
R_f cold = 0.008Ω
100
80
60
40
20
0
0
2
4
6
V_f (V)
8

WATER COOLED
INDUSTRIAL R.F. POWER TRIODE

QUICK REFERENCE DATA		
Freq. (MHz)	C osc. industrial	
	V_a (kV)	W_o (kW)
30	12	39
	10	31.3
	8	23.2

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	8	V	+5 % −10 %
Filament current	I_f	=	130	A	
Cold filament resistance	R_{fo}	=	0.006	Ω	

The filament current must never exceed a peak value of 280 A at any time during the initial energizing schedule

CAPACITANCES

Anode to all other elements except grid	C_a	=	0.9	pF
Grid to all other elements except anode	C_g	=	45	pF
Anode to grid	C_{ag}	=	23.5	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	12	kV
Anode current	I_a	=	2	A
Amplification factor	μ	=	21	
Mutual conductance	S	=	25	mA/V

TEMPERATURE LIMITS (Absolute limits)

Temperature of all seals		=	max.	220	°C
Water inlet temperature	t_i	=	max.	50	°C

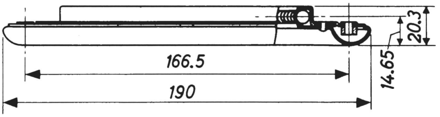
COOLING: Generally a low velocity air flow to the seals is required

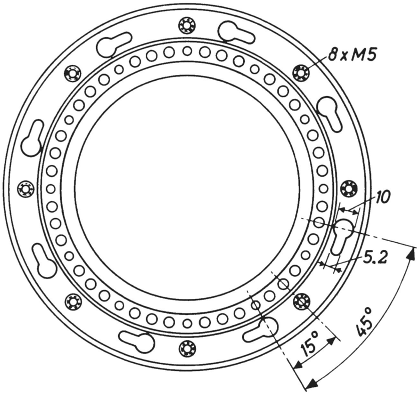
WATER COOLING CHARACTERISTICS. See also page A

W_a (kW)	t_i (^oC)	q_{min} (l/min)	p_i (atm.)
5	20	6	0.02
	50	15	0.22
10	20	11	0.1
	50	25	0.7
15	20	16	0.25
	50	37	1.3
20	20	22	0.5
	50	49	2.3

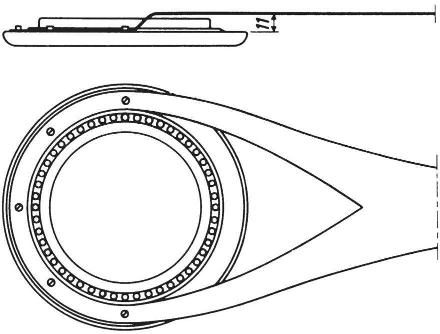
At water inlet temperatures between 20 ^oC and 50 ^oC the required quantity of water can be found by proportional interpolation

MECHANICAL DATA Dimensions in mm





Grid connector 40663



Connection of the grid lead

The rounded side of the grid connector should face the anode. To ensure a uniform RF current distribution in the grid seal at frequencies higher than 4 MHz, the grid lead should be connected as shown in the figure at right. 7Z2 3563

MECHANICAL DATA (continued)

Dimensions in mm

Water jacket : K722

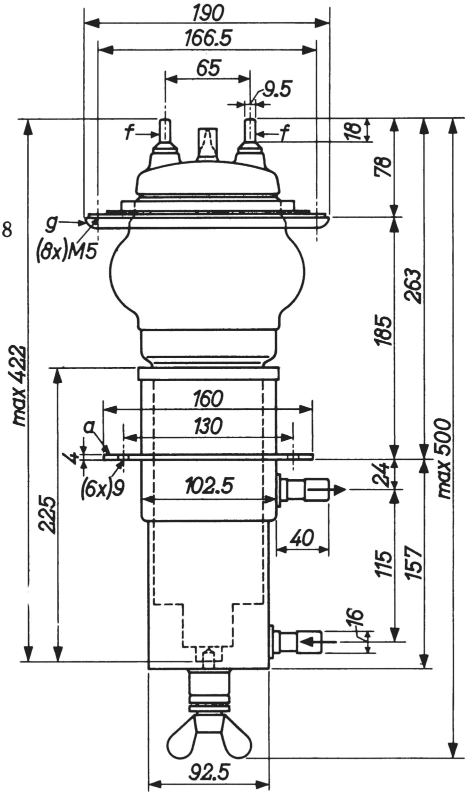
Filament connectors : 40662

Grid connector : 40663

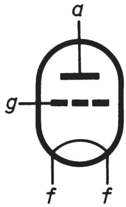
Net weight of the tube : 3.0 kg

Net weight of water jacket : 2.7 kg

→ O-ring : 2622 080 31788

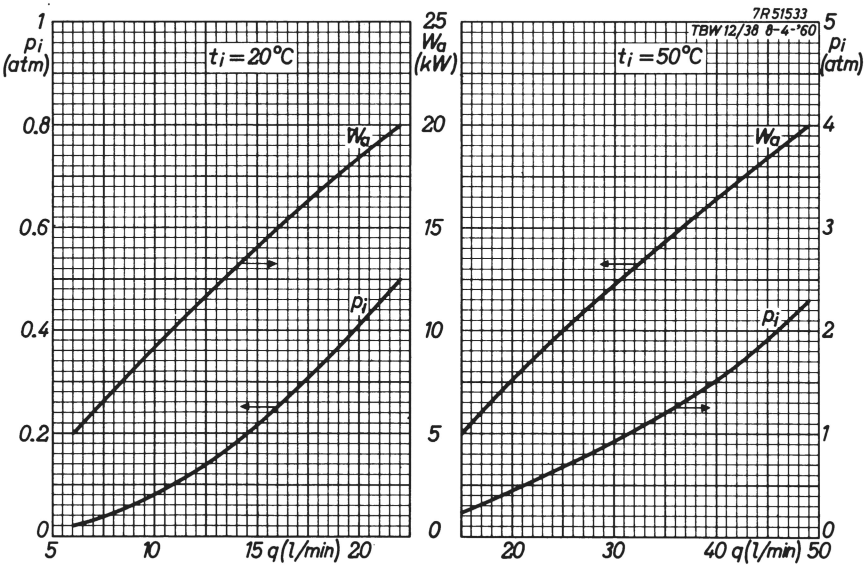

190
166.5
65
9.5
f
f
18
78
g
(8x)M5
263
185
max 422
max 500
160
130
a
4
(6x)9
102.5
24
225
40
115
157
16
92.5

Tube mounted in water jacket



Mounting position: vertical with anode down

For further data and curves (except cooling curves)
please refer to type TBH 12/38


7R51533
TBW 12/38 8-4-'60
1
p_i
(atm)
0.8
0.6
0.4
0.2
0
5
10
15 q(l/min) 20
25
W_a
(kW)
20
15
10
5
0
t_i = 20°C
W_a
p_i
t_i = 50°C
W_a
p_i
20
30
40 q(l/min) 50
5
p_i
(atm)
4
3
2
1
0

WATER COOLED R.F. POWER TRIODE

QUICK REFERENCE DATA

General purposes

λ (m)	Freq. (MHz)	C telegr.		B teleph.		C an.mod.		B mod. 1)	
		V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)
20	15	12	108	12	51.5	10	80	12	202
15	20	12	94.5			10	54.5	10	116
12	25	11	70			9	42.5	10	77
11	27.5	10.5	59			8.5	36.5	9	62
10	30	10	50			8	31	8.5	54
								8	46.8

Television service

Freq. (MHz)	Neg. mod., pos. sync. 1)	
	V_a (kV)	W_o sync (kW)
48-68	6.5	100 2)

HEATING: direct; filament thoriated tungsten

Filament voltage V_f = 17.5 V
Filament current I_f = 196 A
Cold filament resistance R_{fo} = 0.012 Ω

The filament current must never exceed a peak value of 420 A at any time during the initial energizing schedule

CAPACITANCES

Anode to all other elements except grid C_a = 3.4 pF

Grid to all other elements except anode C_g = 116 pF

Anode to grid C_{ag} = 86 pF

---

1) Two tubes

2) Power transferred from driving stage included

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	3	10	kV
Anode current	I_a	=	50	5	A
Amplification factor	μ	=	–	27	
Mutual conductance	S	=	–	50	mA/V
Maximum mutual conductance	S_{max}	=	92	–	mA/V

TEMPERATURE LIMITS (Absolute limits)

Water inlet temperature t_i = max. 50 °C

Temperature of seals = max. 180 °C

WATER COOLING CHARACTERISTICS; see also cooling curves

W_a (kW)	t_i (°C)	q_{min} (l/min)	p_i (atm)
30	20	25	0.15
	50	45	0.45
50	20	32	0.25
	50	65	0.85
100	20	55	0.6
	50	120	3.0

At water inlet temperatures between 20 and 50 °C the required quantity of water can be found by proportional interpolation.

To keep the seal temperatures below 180 °C it will often be necessary to direct an air flow of sufficient velocity to the seals. This air flow must be started upon or before the application of the filament voltage.
Anode and grid seals can be cooled by connecting a blower of suitable size to the air inlet of the anticorona ring, attached to the tube. At frequencies below 6 MHz air cooling will, as a rule, not be necessary. Above 6 MHz air cooling must be used in order to prevent overheating of anode and grid seals.
At maximum frequency (30 MHz) and at the published operating conditions at least 2.5 m^3 per minute is required with a pressure loss of about 500 mm water column.

MECHANICAL DATA

Dimensions in mm

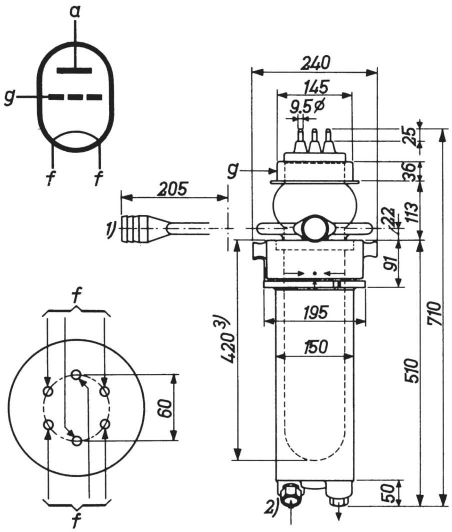
Water jacket : K714

Filament connectors: 40628

O-ring : 2622 080 31817

Net weight of tube : 14 kg

Net weight of water-jacket: 20.5 kg



Mounting position: vertical with anode down

When connecting the filament the three pins of each group must be joined.

When using the special filament connectors type No. 40628, together with connecting leads of adequate cross-section, additional air cooling of the filament terminals is, as a rule, not necessary.

Care should be taken to ensure form contact of the filament terminals in order to obtain equal distribution of current over these terminals.

---

1) Use connecting hose with an inner diameter of 1 3/4".

2) Coupling for metal tubing with an outer diameter of 28 mm.

3) For removing the tube from its water-jacket the free height above the tube must be at least 420 mm.

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (absolute limits)

Frequency	f	up to	4	15	30	MHz
Anode voltage	V_a	max.	15	13.5	10	kV
Anode current	I_a	max.	12	12	10	A
Anode input power	W_{ia}	max.	162	162	80	kW
Anode dissipation	W_a	max.		50		kW
Negative grid voltage	$-V_g$	max.		1200		V
Grid current	I_g	max.		3		A

OPERATING CONDITIONS

Wavelength	λ	=	20	15	12	11	10	m
Frequency	f	=	15	20	25	27.5	30	MHz
Anode voltage	V_a	=	12	12	11	10.5	10	kV
Grid voltage	V_g	=	-1000	-1000	-900	-850	-800	V
Anode current	I_a	=	12	10.5	8.5	7.5	6.7	A
Grid current	I_g	=	2.25	2	1.6	1.5	1.4	A
Peak grid A.C. voltage	V_{gp}	=	1700	1650	1450	1350	1300	V
Grid input power	W_{ig}	=	3.5	3	2.1	1.9	1.7	kW
Anode input power	W_{ia}	=	144	126	93.5	79	67	kW
Anode dissipation	W_a	=	36	31.5	23.5	20	17	kW
Output power	W_o	=	108	94.5	70	59	50	kW
Efficiency	η	=	75	75	75	75	75	%

R.F. CLASS B TELEPHONY (two tubes)

LIMITING VALUES (Absolute limits)

Frequency	f		up to 4	up to 15	MHz
Anode voltage	V_a	=	max. 15	max. 13.5	kV
Anode current	I_a	=	max. 12.5		A
Anode input power	W_{i_a}	=	max. 150		kW
Anode dissipation	W_a	=	max. 100		kW

OPERATING CONDITIONS (two tubes)

Wavelength	λ	=	20	m
Frequency	f	=	15	MHz
Anode voltage	V_a	=	12	kV
Grid voltage	V_g	=	−420	V
Anode current	I_a	=	12.2	A
Peak grid A.C. voltage	V_{g_p}	=	700	V
Anode input power	W_{i_a}	=	146	kW
Anode dissipation	W_a	=	94.5	kW
Output power	W_o	=	51.5	kW
Efficiency	η	=	35	%
Modulation depth	m	=	100	%
Grid current	I_g	=	4.5	A
Grid input power	W_{ig}	=	5.7	kW

7Z2 8711

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

Frequency	f		up to 15	20	30	MHz
Anode voltage	V_a	=	max. 10	10	8	kV
Anode input power	W_{ia}	=	max. 105	80	50	kW
Anode dissipation	W_a	=		max. 30		kW
Anode current	I_a	=		max. 10.5		A
Negative grid voltage	$-V_g$	=		max. 1200		V
Grid current	I_g	=		max. 3.5		A

OPERATING CONDITIONS

f	=	15	15	20	25	27.5	30	MHz
V_a	=	10	10	10	9	8.5	8	kV
V_g	=	-1050	-1050	-1050	-925	-900	-850	V 1)
I_a	=	10.5	8.5	7.0	6.2	5.7	5.25	A
I_g	=	3.5	2.6	2.0	2.0	1.9	1.8	A
V_{gp}	=	1960	1750	1650	1500	1450	1400	V
W_{ig}	=	6.2	4.1	3.0	2.7	2.5	2.3	kW
W_{ia}	=	105	85	70	56	48.5	42	kW
W_a	=	25	17	15.5	13.5	12	11	kW
W_o	=	80	68	54.5	42.5	36.5	31	kW
η	=	76	80	78	76	75	74	%
m	=	100	100	100	100	100	100	%
W_{mod}	=	52.5	42.5	35	28	24.5	21	kW

---

1) Grid bias partially obtained by the grid resistor

7Z2 8712

A.F. CLASS B AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	=	max.	15	kV
Anode current	I_a	=	max.	12	A
Anode input power	W_{ia}	=	max.	162	kW
Anode dissipation	W_a	=	max.	50	kW
Grid circuit resistance	R_g	=	max.	20	kΩ

OPERATING CONDITIONS, two tubes

V_a	=	12		10		10		kV
V_g	=	−450		−375		−400		V
$R_{aa\sim}$	=	1200		1500		2060		Ω
V_{gg_p}	=	0	2060	0	1680	0	1460	V
I_a	=	2x0.65	2x12	2x0.5	2x7.9	2x0.2	2x5.4	A
I_g	=	0	2x2.5	0	2x1.9	0	2x0.7	A
W_{ig}	=	0	2x2.4	0	2x1.44	0	2x0.5	kW
W_{ia}	=	2x7.8	2x144	2x5	2x79	2x2	2x54	kW
W_a	=	2x7.8	2x43	2x5	2x21	2x2	2x15.5	kW
W_o	=	0	202	0	116	0	77	kW
η	=	–	70	–	75	–	71	%

V_a	=	9		8.5		8		kV
V_g	=	−350		−325		−300		V
$R_{aa\sim}$	=	2080		2120		2210		Ω
V_{gg_p}	=	0	1300	0	1200	0	1120	V
I_a	=	2x0.25	2x4.8	2x0.25	2x4.4	2x0.25	2x4.1	A
I_g	=	0	2x0.65	0	2x0.55	0	2x0.4	A
W_{ig}	=	0	2x0.4	0	2x0.3	0	2x0.25	kW
W_{ia}	=	2x2.25	2x43.2	2x2.1	2x37.4	2x2	2x32.8	kW
W_a	=	2x2.25	2x12.2	2x2.1	2x10.4	2x2	2x9.4	kW
W_o	=	0	62	0	54	0	46.8	kW
η	=	–	72	–	72	–	71	%

7Z2 3591

R.F. CLASS B AMPLIFIER for television service, negative modulation, positive synchronisation

LIMITING VALUES (Absolute limits)

Frequency	f			up to	68	MHz
Anode voltage	V_a		=	max.	6.5	kV
Anode current	I_a	sync	=	max.	16	A
Anode input power	W_{ia}	sync	=	max.	100	kW
Anode dissipation	W_a	sync	=	max.	50	kW
Grid current	I_g	sync	=	max.	2	A

OPERATING CONDITIONS, two tubes in push-pull

Frequency	f		=	48 to 68	MHz 1)
Bandwidth (-1.5 dB)	B		=	5.5	MHz 2)
Bandwidth (-3 dB)	B		=	7.5	MHz 2)
Anode voltage	V_a		=	6.5	kV
Grid voltage	V_g		=	-250	V
Peak grid to grid A.C. voltage	V_{ggp}	sync	=	1740	V 3)
		black	=	1300	V 3)
Anode current	I_a	sync	=	32	A
		black	=	24	A
Grid current	I_g	sync	=	3.4	A
		black	=	2.2	A
Grid input power	W_{ig}	sync	=	22.4	kW 4)
Output power	W_o	sync	=	80+20	kW 5)
		black	=	45+11	kW 5)

---

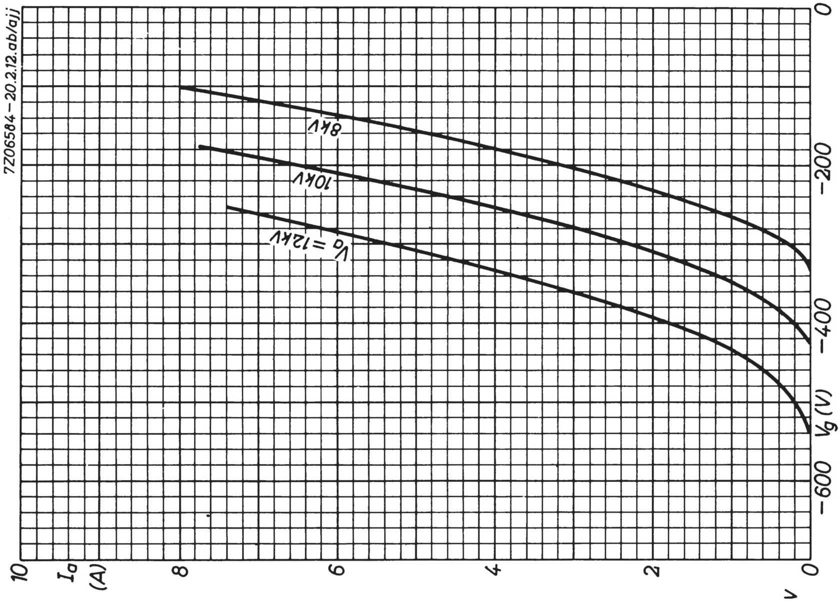
1) In the frequency range of 60 to 68 MHz a special version of the tube is necessary.

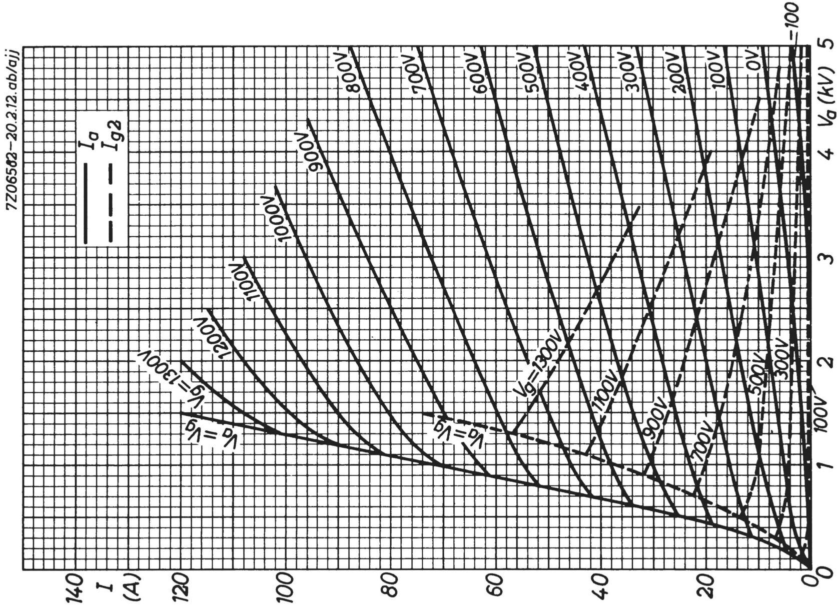
2) This value of bandwidth is based on measurements on a circuit with a single LC section

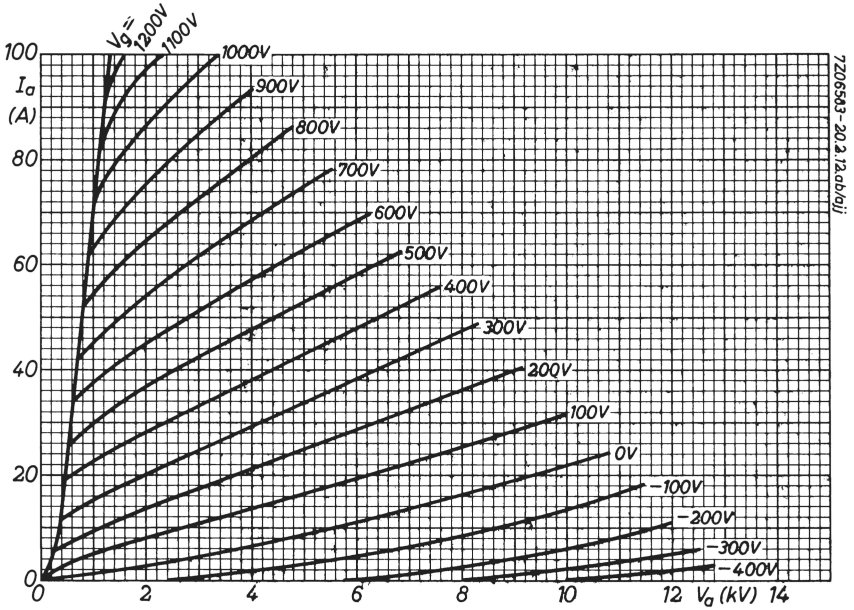
3) Measured by the slide back method

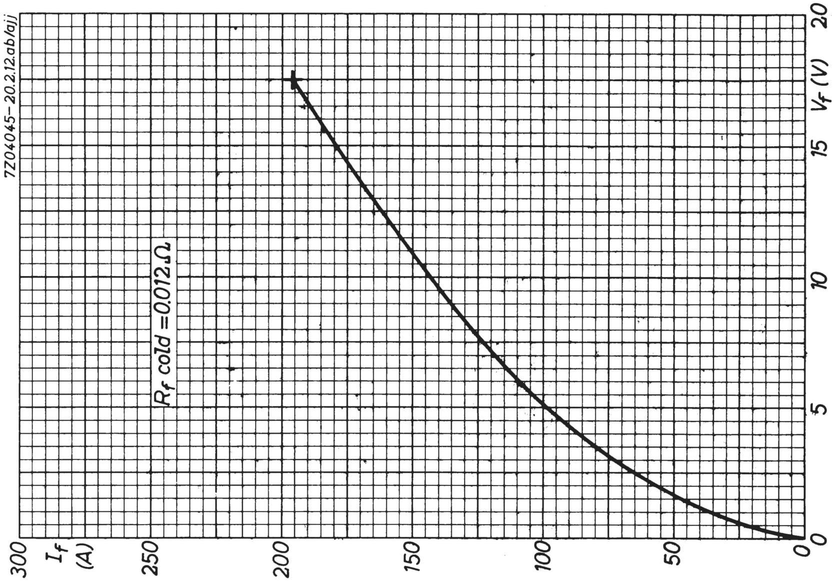
4) Driving power is accounted for largely by circuit losses. The indicated driving power is required to take care of losses in damping resistors, circuit losses and tube driving power.

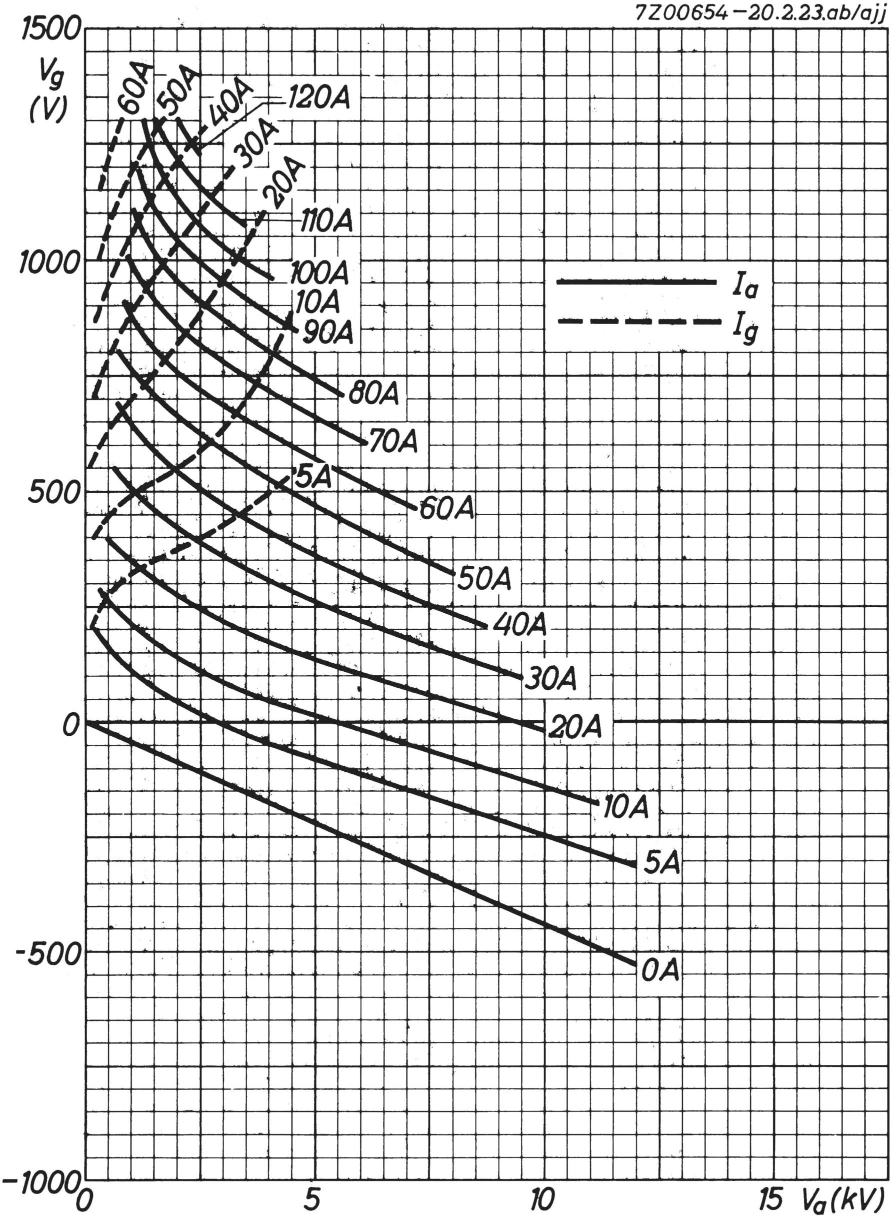
5) Power transferred from driving stage included.

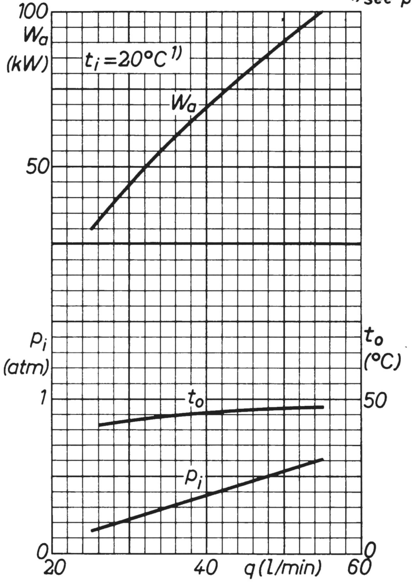

7Z06584-20.2.12.ab/ajj
I_a
(A)
10
8
6
4
2
0
0
-200
-400
-600
V_g (V)
V_a = 12kV
10kV
8kV


7Z06583-20.2.12.ab/ajj
I_a
I_{g2}
140
I
(A)
120
100
80
60
40
20
0
0
1
2
3
4
5
V_a (kV)
V_g=1300V
1200V
1100V
1000V
900V
800V
700V
600V
500V
400V
300V
200V
100V
0V
-100V
V_a=V_g
V_a=V_g
V_g=1300V
1100V
900V
700V
500V
300V
100V


$V_g =$
1200V
1100V
1000V
900V
800V
700V
600V
500V
400V
300V
200V
100V
0V
−100V
−200V
−300V
−400V
100
I_a
(A)
80
60
40
20
0
0
2
4
6
8
10
12
V_a (kV)
14
7Z06563−20.2.12.ab/aij

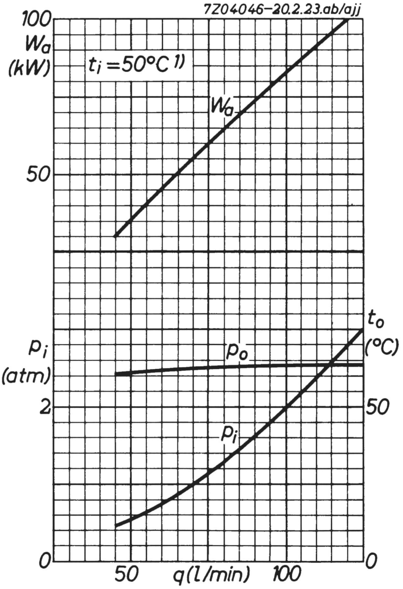

7Z04045−20.2.12.ab/aij
R_f cold = 0.012 Ω
V_f (V)
20
15
10
5
0
I_f
(A)
300
250
200
150
100
50
0


7Z00654–20.2.23.ab/ajj
1500
V_g (V)
1000
500
0
-500
−1000
0
5
10
15
V_a(kV)
I_a
I_g
120A
110A
100A
90A
80A
70A
60A
50A
40A
30A
20A
10A
5A
0A
60A
50A
40A
30A
20A
10A
5A



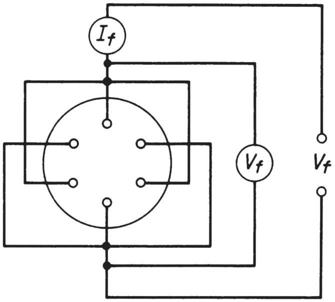
1) see page 2

7Z04046–20.2.23.ab/ajj



WATER COOLED R.F. POWER TRIODE

This type is equivalent to type TBW12/100 except for the filament data

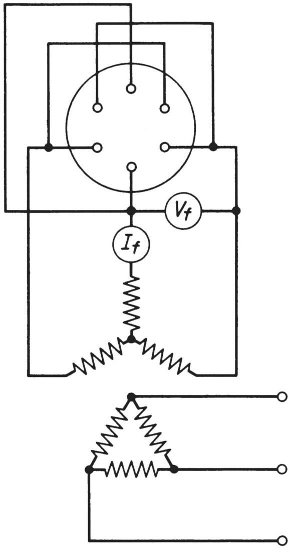


Single-phase filament energizing

V_f = 17.5 V

I_f = 196 A

Filament current must never exceed a peak value of 420 A at any time during the initial energizing schedule



Three-phase filament energizing

V_f = 15.5 V

I_f = 131 A

Filament current must never exceed a peak value of 280 A at any time during the initial energizing schedule

A safety device must be used to prevent filament energizing with one phase interrupted.

7Z2 3596

WATER COOLED R.F. POWER TRIODE

QUICK REFERENCE DATA

Frequency (MHz)	C telegraphy		C anode mod.		RF class B		AF class B Two tubes	
	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)
10	15	120			15	110	12	78
30	12	90	11	66	12	110	10	78

HEATING: direct by A.C. or D.C.; filament thoriated tungsten

Filament voltage V_f = 12.6 V

Filament current I_f = 160 A

CAPACITANCES

Grid to filament C_{gf} = 120 pF

Anode to filament C_{af} = 1.4 pF

Anode to grid C_{ag} = 50 pF

TYPICAL CHARACTERISTICS

Anode voltage V_a = 3 kV

Anode current I_a = 1 A

Amplification factor μ = 58

Mutual conductance S = 60 mA/V

TEMPERATURE LIMITS (Absolute limits)

Bulb temperature t = max. 220 °C

Seal temperature t = max. 220 °C

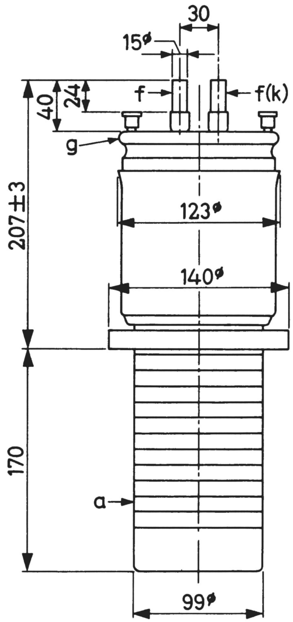
COOLING

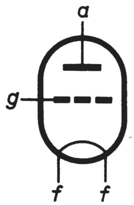
For cooling data see cooling curves.
For water inlet temperatures between 20 °C and 50 °C the required quantity of water can be found by proportional interpolation.
At frequencies higher than 10 MHz a low velocity air flow should be directed to the grid and filament seals.

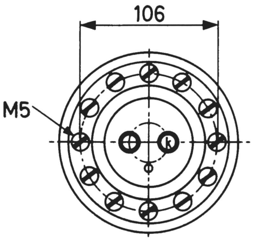
MECHANICAL DATA

Dimensions in mm

Net weight: 6.2 kg


30
15ø
f
f(k)
40
24
g
207±3
123ø
140ø
170
a
99ø





Mounting position: vertical with anode down

ACCESSORIES

Water jacket	K724
Filament connector	40670
Grid connector	40671

R.F. CLASS C TELEGRAPHY or F.M. TELEPHONY

LIMITING VALUES (Absolute limits)

Frequency	f		up to	10	up to	30	MHz
Anode voltage	V_a	=	max.	16	max.	12.5	kV
Anode dissipation	W_a	=	max.	45	max.	45	kW
Negative grid voltage	$-V_g$	=	max.	1000	max.	1000	V
Grid dissipation	W_g	=	max.	1.3	max.	1.3	kW
Anode current	I_a	=	max.	13	max.	13	A
Grid current	I_g	=	max.	3.3	max.	3.3	A

OPERATING CONDITIONS

Frequency	f	=	10	30	30	30	MHz
Anode voltage	V_a	=	15	12	10	8	kV
Grid voltage	V_g	=	-600	-550	-500	-450	V
Anode current	I_a	=	9.75	9.25	9.0	8.75	A
Grid current	I_g	=	2.2	2.2	2.1	1.85	A
Peak grid driving voltage	V_{gp}	=	1000	940	875	810	V
Grid driving power	W_{dr}	=	2.1	1.9	1.7	1.55	kW
Anode input power	W_{ia}	=	146	111	90	70	kW
Anode dissipation	W_a	=	26	21	18	15	kW
Output power	W_o	=	120	90	72	55	kW
Efficiency	η	=	82	81	80	78.5	%

R.F. CLASS B AMPLIFIER

LIMITING VALUES (Absolute limits)

Frequency	f		up to 10	up to 30	MHz
Anode voltage	V_a	=	max. 16	max. 12.5	kV
Anode dissipation	W_a	=	max. 45	max. 45	kW
Negative grid voltage	$-V_g$	=	max. 1000	max. 1000	V
Grid dissipation	W_g	=	max. 1.3	max. 1.3	kW
Anode current	I_a	=	max. 13	max. 13	A
Grid current	I_g	=	max. 3.3	max. 3.3	A

OPERATING CONDITIONS

Frequency	f	=	10	10	30	30	MHz
Anode voltage	V_a	=	15	15	12	12	kV
Grid voltage	V_g	=	−260	−260	−210	−210	V
Anode current	I_a	=	10.1	7.75	12.7	9.85	A
Grid current	I_g	=	2.0	1.3	3.0	1.9	A
Peak grid driving voltage	V_{g_p}	=	600	520	650	520	V
Grid driving power	W_{dr}	=	1080	610	1770	880	W
Anode input power	W_{i_a}	=	151	116.3	153	118	kW
Anode dissipation	W_a	=	41	31.3	43	33	kW
Output power	W_o	=	110	85	110	85	kW
Efficiency	η	=	73	73	72	72	%

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

Frequency	f		up to	30	MHz
Anode voltage	V_a	=	max.	11.5	kV
Anode dissipation	W_a	=	max.	30	kW
Negative grid voltage	$-V_g$	=	max.	1000	V
Grid dissipation	W_g	=	max.	1.3	kW
Anode current	I_a	=	max.	9	A
Grid current	I_g	=	max.	3.3	A

OPERATING CONDITIONS

Frequency	f	=	30	30	MHz
Anode voltage	V_a	=	11	10	kV
Grid voltage	V_g	=	-480	-440	V 1)
Anode current	I_a	=	7.6	6.9	A
Grid current	I_g	=	3.1	3.1	A
Grid resistor	R_g	=	90	80	Ω
Peak grid driving voltage	V_{gp}	=	880	810	V
Grid driving power	W_{dr}	=	2.7	2.4	kW
Anode input power	W_{i_a}	=	83.6	69	kW
Anode dissipation	W_a	=	17.6	14	kW
Output power	W_o	=	66	55	kW
Efficiency	η	=	79	79	%
Modulation depth	m	=	100	100	%
Modulation power	W_{mod}	=	41.8	34.5	kW

---

1) Partially obtained by the grid resistor and grid current.

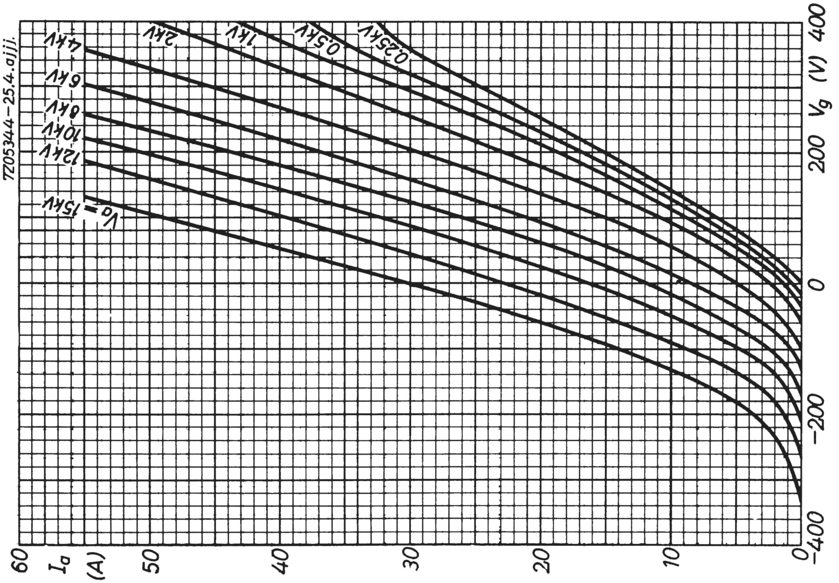
A.F. CLASS B AMPLIFIER AND MODULATOR

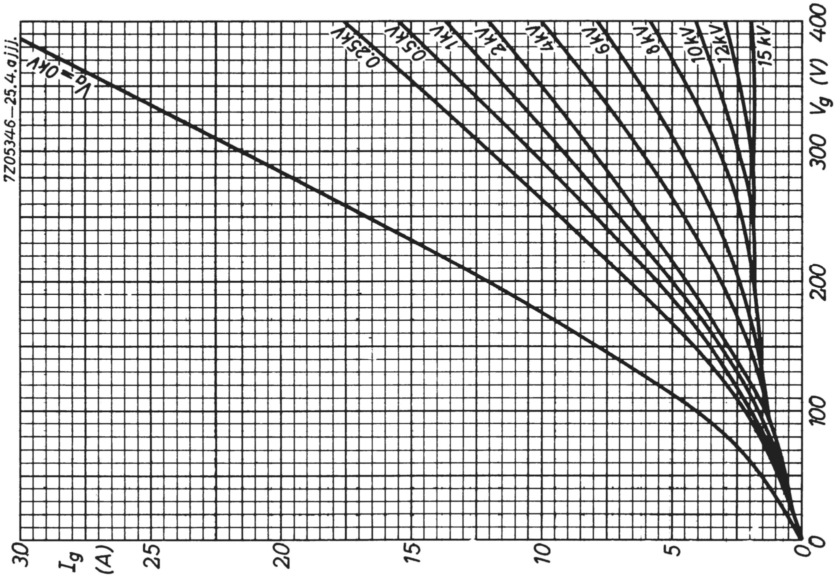
LIMITING VALUES (Absolute limits)

Anode voltage	V_a	=	max.	12	kV
Anode dissipation	W_a	=	max.	45	kW
Negative grid voltage	$-V_g$	=	max.	1000	V
Grid dissipation	W_g	=	max.	1.3	kW
Anode current	I_a	=	max.	13	A
Grid current	I_g	=	max.	3.3	A

OPERATING CONDITIONS (two tubes in push-pull)

Anode voltage	V_a	=	12		10		kV
Grid voltage	V_g	=	-205		-170		V
Load resistance	$R_{aa\sim}$	=	2720		1810		Ω
Peak grid driving voltage	V_{gg_p}	=	0	710	0	710	V
Anode current	I_a	=	2x0.4	2x4.75	2x0.4	2x5.75	A
Average grid current	I_g	=	0	2x0.45	0	2x0.72	A
Peak grid current	I_{g_p}	=	0	2x2.9	0	2x4.0	A
Grid driving power	W_{dr}	=	0	2x150	0	2x235	W
Anode input power	W_{i_a}	=	2x4.0	2x57	2x4.0	2x57.5	kW
Anode dissipation	W_a	=	2x4.0	2x18	2x4.0	2x18.5	kW
Output power	W_o	=	0	78	0	78	kW
Efficiency	η	=	–	68.5	–	68	%


7Z05344-25.4.aijj.
I_a (A)
0
10
20
30
40
50
60
V_g (V)
−400
−200
0
200
400
V_a = 15kV
12kV
10kV
8kV
6kV
4kV
2kV
1kV
0.5kV
0.25kV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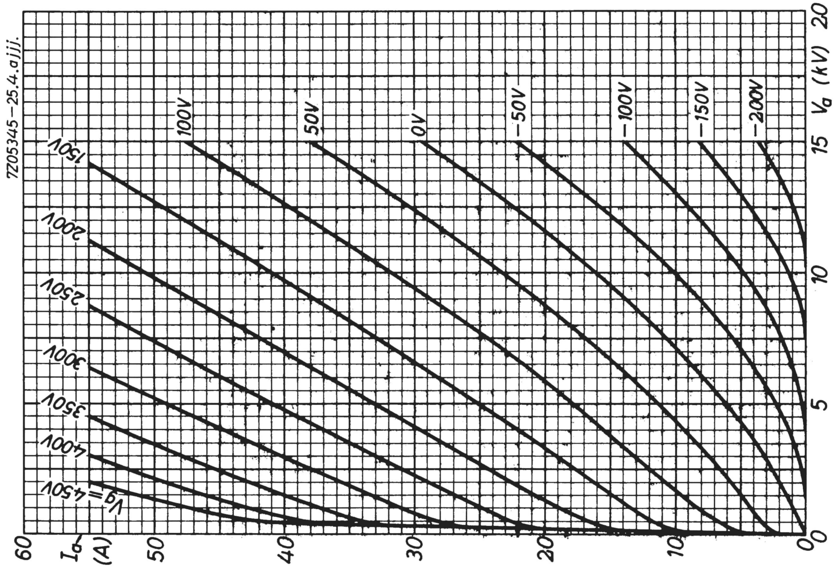
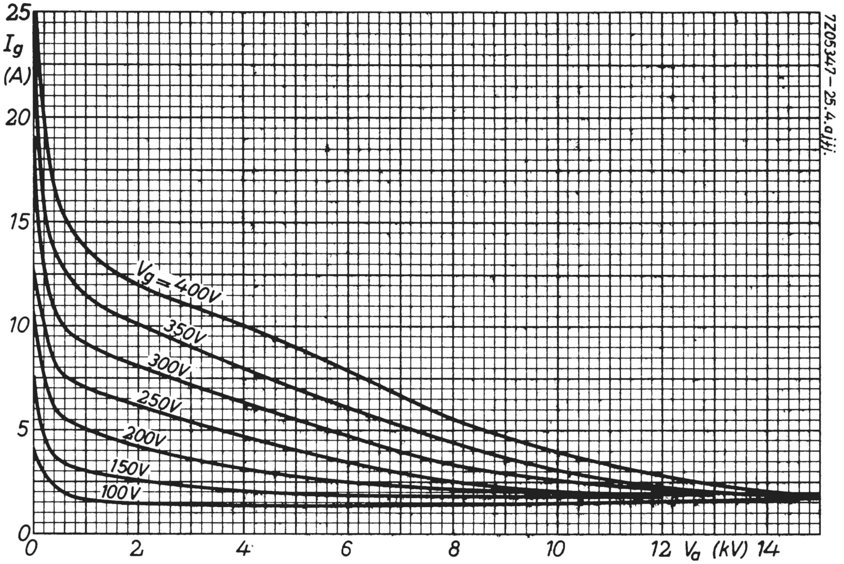
I_g (A)
0
5
10
15
20
25
30
V_g (V)
0
100
200
300
400
V_a = 0kV
0.25kV
0.5kV
1kV
2kV
4kV
6kV
8kV
10kV
12kV
15 kV


7Z05345—25.4.ajjj.
V_a (kV)
0
5
10
15
20
I_a (A)
0
10
20
30
40
50
60
V_g = 450V
400V
350V
300V
250V
200V
150V
100V
50V
0V
−50V
−100V
−150V
−200V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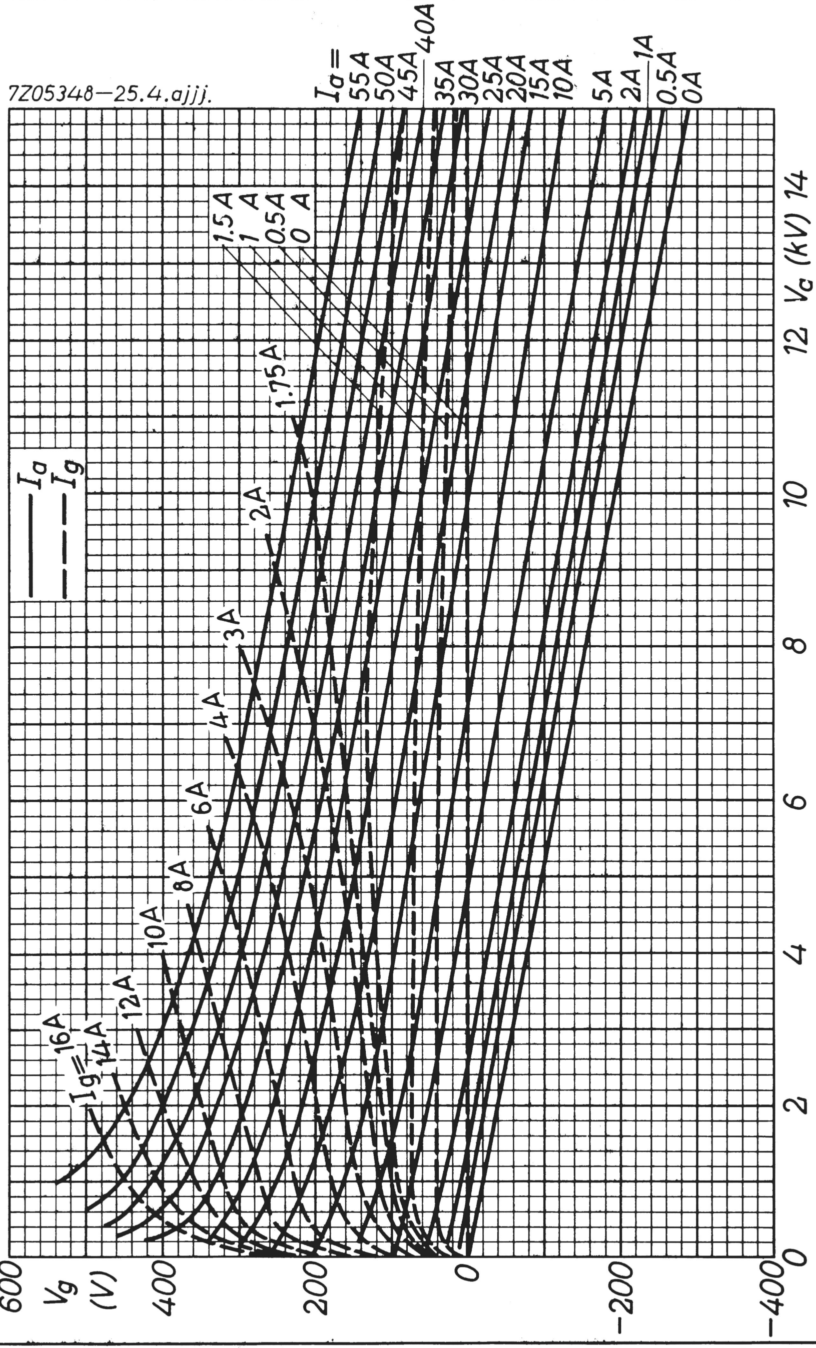
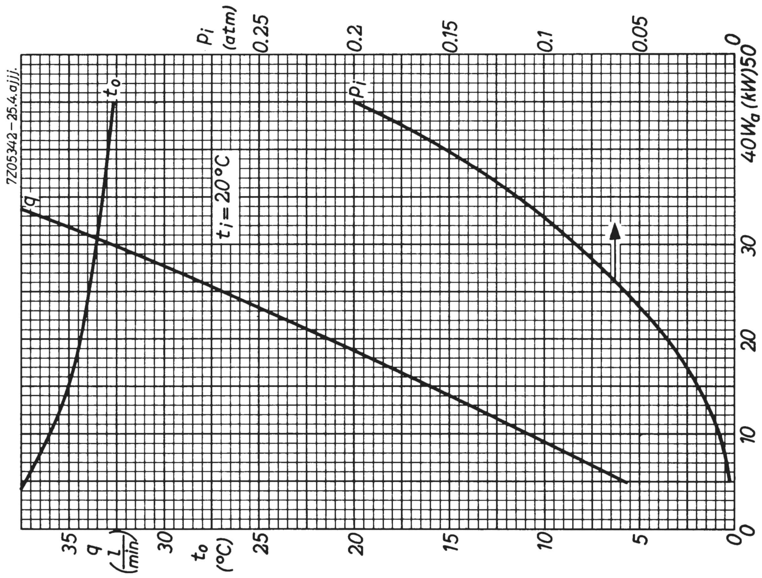
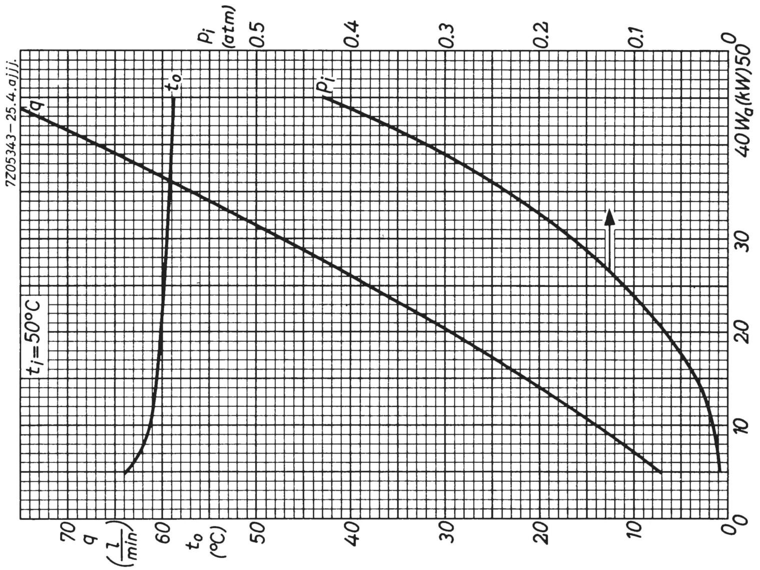
I_g (A)
0
5
10
15
20
25
V_a (kV)
0
2
4
6
8
10
12
14
V_g = 400V
350V
300V
250V
200V
150V
100V


7Z05348—25.4.ajjj.
I_a =
55A
50A
45A
40A
35A
30A
25A
20A
15A
10A
5A
2A
1A
0.5A
0A
1.5A
1 A
0.5A
0 A
1.75A
2A
3A
4A
6A
8A
10A
12A
14A
I_g = 16A
I_a
I_g
V_a (kV)
0
2
4
6
8
10
12
14
V_g (V)
600
400
200
0
−200
−400


7Z05342-25.4.ajjj.
$t_i = 20°C$
q
t_o
p_i
p_i (atm)
0.25
0.2
0.15
0.1
0.05
0
q ($\frac{l}{min}$)
t_o (°C)
35
30
25
20
15
10
5
0
0
10
20
30
40
W_a (kW)
50


7Z05343-25.4.ajjj.
$t_i = 50°C$
q
t_o
p_i
p_i (atm)
0.5
0.4
0.3
0.2
0.1
0
q ($\frac{l}{min}$)
t_o (°C)
70
60
50
40
30
20
10
0
0
10
20
30
40
W_a (kW)
50

AIR COOLED R.F. POWER TRIODE

QUICK REFERENCE DATA								
Frequency (MHz)	C telegraphy		C anode mod.		RF class B		AF class B Two tubes	
	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)
10	15	120			15	110	12	78
30	12	90	11	66	12	110	10	78

HEATING: direct by A.C. or D.C.; filament thoriated tungsten

Filament voltage	V_f	=	12.6	V
Filament current	I_f	=	160	A

CAPACITANCES

Grid to filament	C_{gf}	=	120	pF
Anode to filament	C_{af}	=	1.4	pF
Anode to grid	C_{ag}	=	50	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	3	kV
Anode current	I_a	=	1	A
Amplification factor	μ	=	58	
Mutual conductance	S	=	60	mA/V

TEMPERATURE LIMITS (Absolute limits)

Bulb temperature	t	=	max. 220	°C
Seal temperature	t	=	max. 220	°C

COOLING

For cooling data see cooling curves. These curves are for an air inlet temperature of 25 °C.

At lower temperatures the amount of air should be the same.

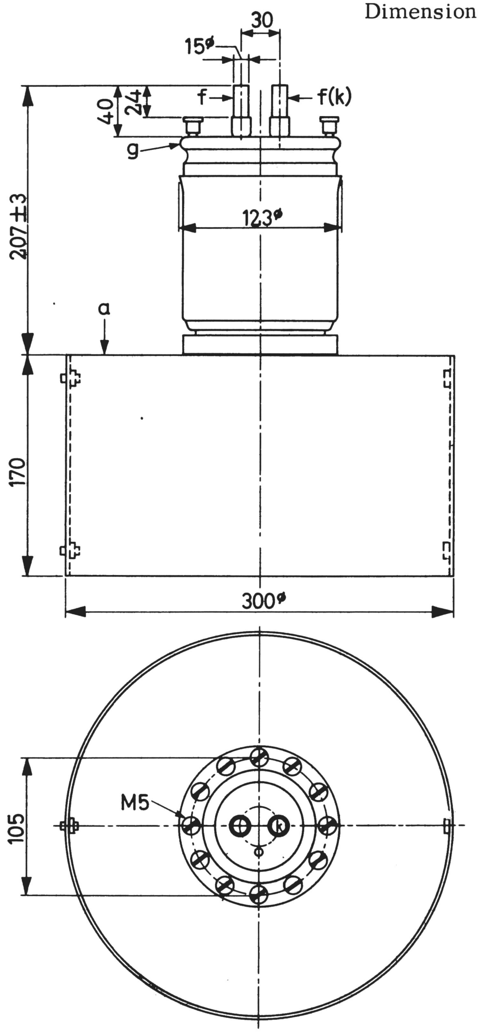
At higher temperatures the amount of air should be increased so that the outlet air temperature is not higher than at t_i = 25 °C.

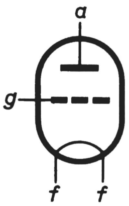
At frequencies higher than 10 MHz a low velocity air flow should be directed to the grid and filament seals.

MECHANICAL DATA

Net weight: 39 kg

Dimensions in mm


30
15ø
f
f(k)
40
24
g
123ø
207±3
a
170
300ø
105
M5
k



ACCESSORIES

Insulating pedestal	40672
Filament connector	40670
Grid connector	40671

Mounting position: vertical
with anode down

R.F. CLASS C TELEGRAPHY or F.M. TELEPHONY

LIMITING VALUES (Absolute limits)

Frequency	f		up to	10	up to	30	MHz
Anode voltage	V_a	=	max.	16	max.	12.5	kV
Anode dissipation	W_a	=	max.	35	max.	35	kW
Negative grid voltage	$-V_g$	=	max.	1000	max.	1000	V
Grid dissipation	W_g	=	max.	1.3	max.	1.3	kW
Anode current	I_a	=	max.	13	max.	13	A
Grid current	I_g	=	max.	3.3	max.	3.3	A

OPERATING CONDITIONS

Frequency	f	=	10	30	30	30	MHz
Anode voltage	V_a	=	15	12	10	8	kV
Grid voltage	V_g	=	-600	-550	-500	-450	V
Anode current	I_a	=	9.75	9.25	9.0	8.75	A
Grid current	I_g	=	2.2	2.2	2.1	1.85	A
Peak grid driving voltage	V_{gp}	=	1000	940	875	810	V
Grid driving power	W_{dr}	=	2.1	1.9	1.7	1.55	kW
Anode input power	W_{ia}	=	146	111	90	70	kW
Anode dissipation	W_a	=	26	21	18	15	kW
Output power	W_o	=	120	90	72	55	kW
Efficiency	η	=	82	81	80	78.5	%

R.F. CLASS B AMPLIFIER

LIMITING VALUES (Absolute limits)

Frequency	f		up to	10	up to	30	MHz
Anode voltage	V_a	=	max.	16	max.	12.5	kV
Anode dissipation	W_a	=	max.	35	max.	35	kW
Negative grid voltage	$-V_g$	=	max.	1000	max.	1000	V
Grid dissipation	W_g	=	max.	1.3	max.	1.3	kW
Anode current	I_a	=	max.	13	max.	13	A
Grid current	I_g	=	max.	3.3	max.	3.3	A

OPERATING CONDITIONS

Frequency	f	=	10	10	30	30	MHz
Anode voltage	V_a	=	15	15	12	12	kV
Grid voltage	V_g	=	-260	-260	-210	-210	V
Anode current	I_a	=	10.1	7.75	12.7	9.85	A
Grid current	I_g	=	2.0	1.3	3.0	1.9	A
Peak grid driving voltage	V_{g_p}	=	600	520	650	520	V
Grid driving power	W_{dr}	=	1080	610	1770	880	W
Anode input power	W_{i_a}	=	151	116.3	153	118	kW
Anode dissipation	W_a	=	41	31.3	43	33	kW
Output power	W_o	=	110	85	110	85	kW
Efficiency	η	=	73	73	72	72	%

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

Frequency	f		up to	30	MHz
Anode voltage	V_a	=	max.	11.5	kV
Anode dissipation	W_a	=	max.	30	kW
Negative grid voltage	$-V_g$	=	max.	1000	V
Grid dissipation	W_g	=	max.	1.3	kW
Anode current	I_a	=	max.	9	A
Grid current	I_g	=	max.	3.3	A

OPERATING CONDITIONS

Frequency	f	=	30	30	MHz
Anode voltage	V_a	=	11	10	kV
Grid voltage	V_g	=	-480	-440	V ¹)
Anode current	I_a	=	7.6	6.9	A
Grid current	I_g	=	3.1	3.1	A
Grid resistor	R_g	=	90	80	Ω
Peak grid driving voltage	V_{g_p}	=	880	810	V
Grid driving power	W_{dr}	=	2.7	2.4	kW
Anode input power	W_{i_a}	=	83.6	69	kW
Anode dissipation	W_a	=	17.6	14	kW
Output power	W_o	=	66	55	kW
Efficiency	η	=	79	79	%
Modulation depth	m	=	100	100	%
Modulation power	W_{mod}	=	41.8	34.5	kW

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¹) Partially obtained by the grid resistor and grid current.

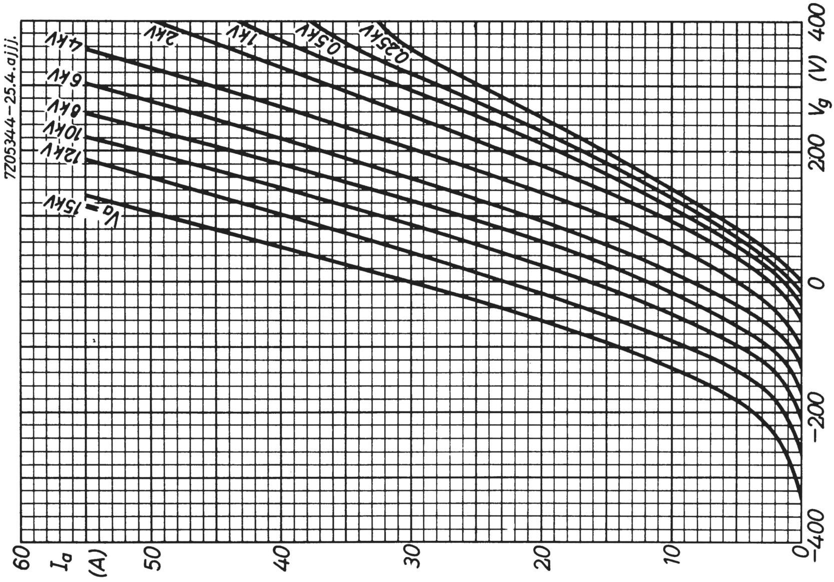
A.F. CLASS B AMPLIFIER AND MODULATOR

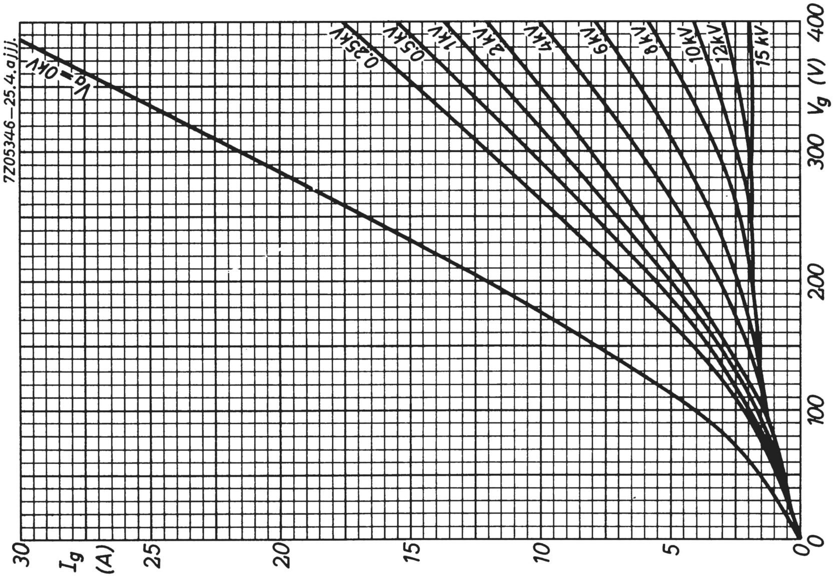
LIMITING VALUES (Absolute limits)

Anode voltage	V_a	=	max.	12	kV
Anode dissipation	W_a	=	max.	35	kW
Negative grid voltage	$-V_g$	=	max.	1000	V
Grid dissipation	W_g	=	max.	1.3	kW
Anode current	I_a	=	max.	13	A
Grid current	I_g	=	max.	3.3	A

OPERATING CONDITIONS (two tubes in push-pull)

Anode voltage	V_a	=	12		10		kV
Grid voltage	V_g	=	−205		−170		V
Load resistance	$R_{aa\sim}$	=	2720		1810		Ω
Peak grid driving voltage	V_{ggp}	=	0	710	0	710	V
Anode current	I_a	=	2x0.4	2x4.75	2x0.4	2x5.75	A
Average grid current	I_g	=	0	2x0.45	0	2x0.72	A
Peak grid current	I_{gp}	=	0	2x2.9	0	2x4.0	A
Grid driving power	W_{dr}	=	0	2x150	0	2x235	W
Anode input power	W_{ia}	=	2x4.0	2x57	2x4.0	2x57.5	kW
Anode dissipation	W_a	=	2x4.0	2x18	2x4.0	2x18.5	kW
Output power	W_o	=	0	78	0	78	kW
Efficiency	η	=	–	68.5	–	68	%


7Z05344-25.4.ajjj.
V_a = 15kV
12kV
10kV
8kV
6kV
4kV
2kV
1kV
0.5kV
0.25kV
V_g (V)
400
200
0
−200
−400
I_a (A)
60
50
40
30
20
10
0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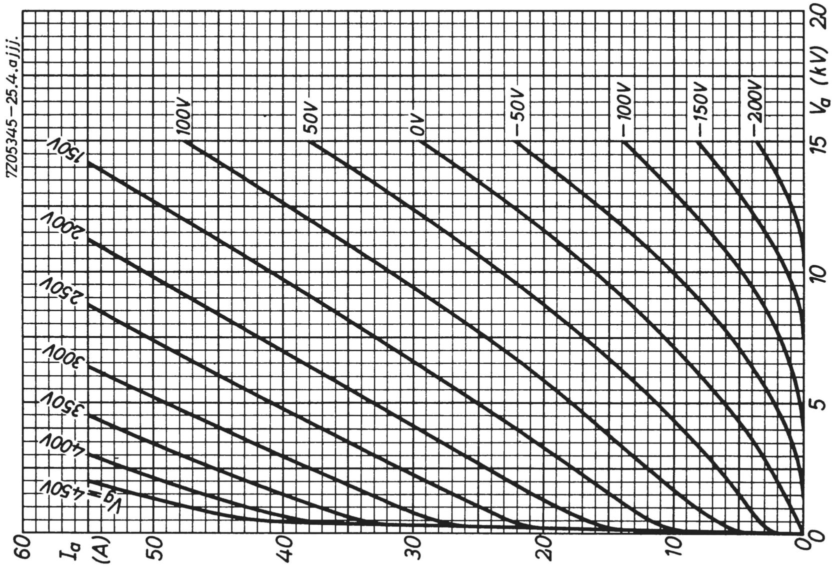
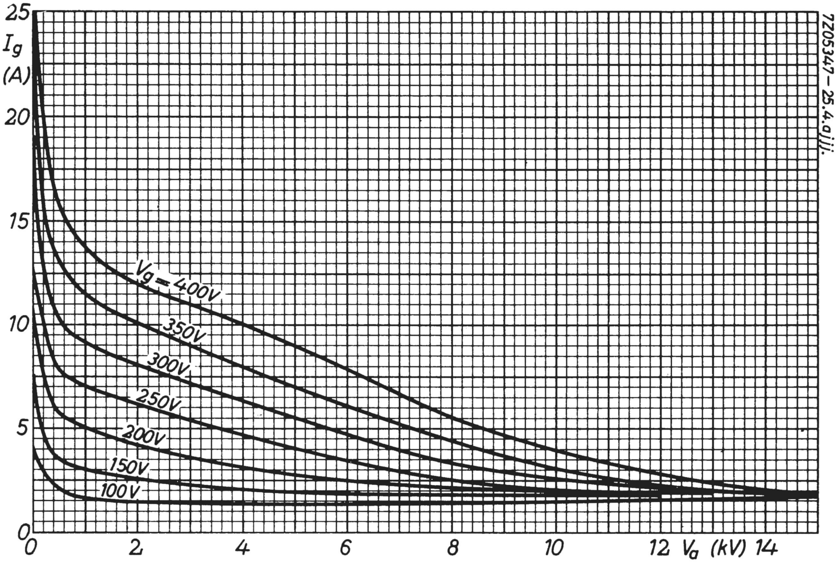
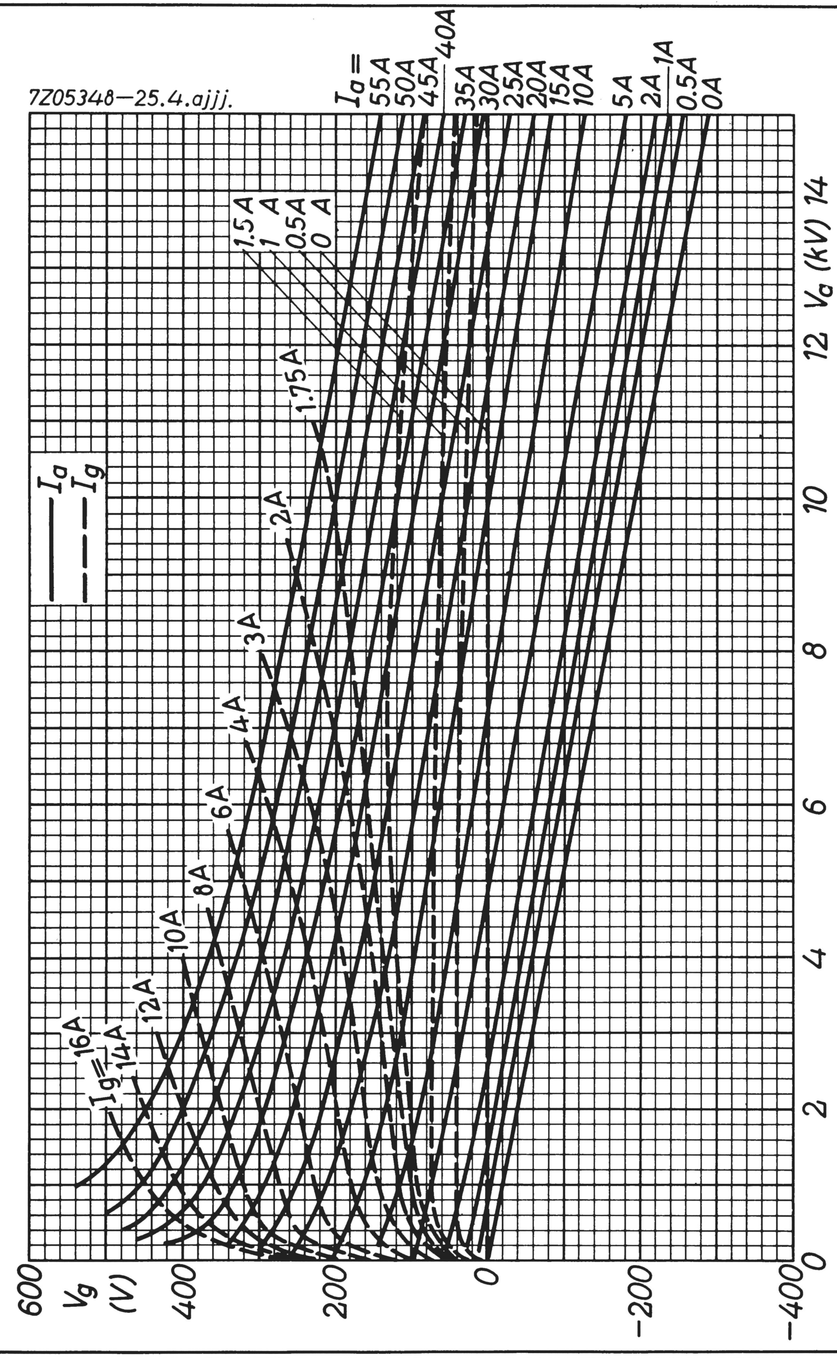
V_a = 0kV
0.25kV
0.5kV
1kV
2kV
4kV
6kV
8kV
10kV
12kV
15kV
V_g (V)
400
300
200
100
0
I_g (A)
30
25
20
15
10
5
0


7Z05345-25.4.ajjj.
I_a (A)
60
50
40
30
20
10
0
V_a (kV)
0
5
10
15
20
V_g = 450V
400V
350V
300V
250V
200V
150V
100V
50V
0V
−50V
−100V
−150V
−200V


I_g (A)
25
20
15
10
5
0
V_a (kV)
0
2
4
6
8
10
12
14
V_g = 400V
350V
300V
250V
200V
150V
100V
7Z05347-25.4.ajjj.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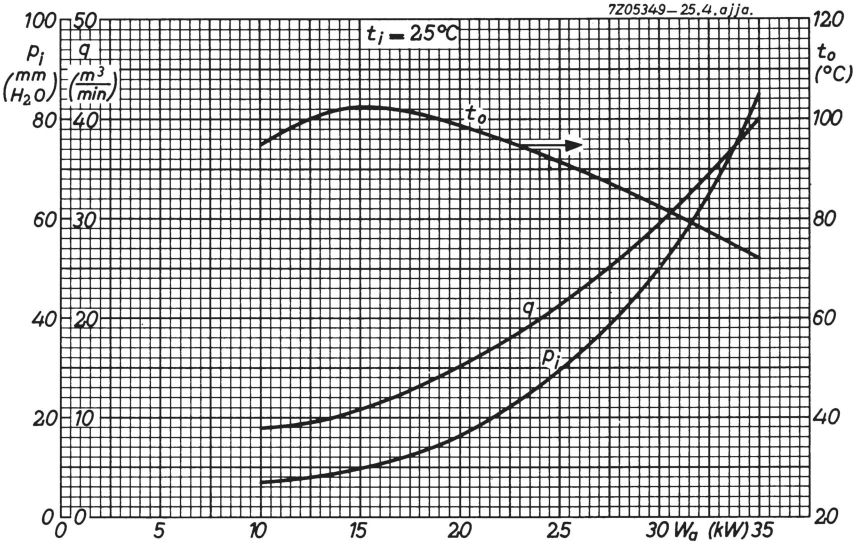
I_a =
55A
50A
45A
40A
35A
30A
25A
20A
15A
10A
5A
2A
1A
0.5A
0A
1.5A
1 A
0.5A
0 A
1.75A
2A
3A
4A
6A
8A
10A
12A
Ig = 16A
14A
I_a
I_g
V_g (V)
600
400
200
0
−200
−400
V_a (kV)
0
2
4
6
8
10
12
14


7Z05349—25.4.ajja.
$t_i = 25°C$
p_i (mm H₂O)
q (m³/min)
t_o (°C)
100
80
60
40
20
0
50
40
30
20
10
0
120
100
80
60
40
20
0
5
10
15
20
25
30
35
W_a (kW)
t_o
q
p_i

VAPOUR COOLED R.F. POWER TRIODE

QUICK REFERENCE DATA								
Frequency (MHz)	C telegraphy		C anode mod.		RF class B		AF class B Two tubes	
	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)
10	15	120			15	110	12	78
30	12	90	11	66	12	110	10	78

HEATING: direct by A.C. or D.C.; filament thoriated tungsten

Filament voltage	V_f	=	12.6	V
Filament current	I_f	=	160	A

CAPACITANCES

Grid to filament	C_{gf}	=	120	pF
Anode to filament	C_{af}	=	1.4	pF
Anode to grid	C_{ag}	=	50	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	3	kV
Anode current	I_a	=	1	A
Amplification factor	μ	=	58	
Mutual conductance	S	=	60	mA/V

TEMPERATURE LIMITS

Bulb temperature	t	= max.	220	°C
Seal temperature	t	= max.	220	°C

COOLING

Cooling data for anode dissipation $W_a = 60$ kW

Total dissipation to be transferred by cooling system

$(W_a + W_g + 0.8\ W_f)$ = 63 kW

equivalent to 900 kcal/min

Volume of produced vapour

at back flow water temperature of 20 °C	2.5	m^3/min
at back flow water temperature of 90 °C	2.8	m^3/min

COOLING (continued)

Amount of back flowing water

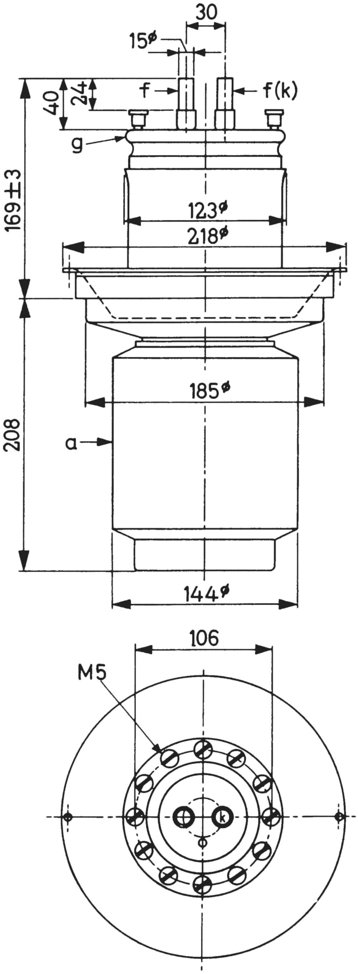
at back flow water temperature of 20 °C	1.5	l/min
at back flow water temperature of 90 °C	1.7	l/min

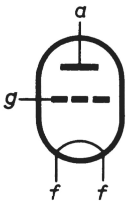
At frequencies higher than 10 MHz a low velocity air flow should be directed to the grid and filament seals.

MECHANICAL DATA

Net weight: 17 kg

Dimensions in mm


30
15ø
40
24
f
f(k)
g
169±3
123ø
218ø
185ø
208
a
144ø
106
M5
k



Mounting position: vertical
with anode down

ACCESSORIES

Vapour cooling system	K728
Filament connectors with cable	40670
Grid connector	40671

R.F. CLASS C TELEGRAPHY or F.M. TELEPHONY

LIMITING VALUES (Absolute limits)

Frequency	f		up to	10	up to	30	MHz
Anode voltage	V_a	=	max.	16	max.	12.5	kV
Anode dissipation	W_a	=	max.	60	max.	60	kW
Negative grid voltage	$-V_g$	=	max.	1000	max.	1000	V
Grid dissipation	W_g	=	max.	1.3	max.	1.3	kW
Anode current	I_a	=	max.	13	max.	13	A
Grid current	I_g	=	max.	3.3	max.	3.3	A

OPERATING CONDITIONS

Frequency	f	=	10	30	30	30	MHz
Anode voltage	V_a	=	15	12	10	8	kV
Grid voltage	V_g	=	-600	-550	-500	-450	V
Anode current	I_a	=	9.75	9.25	9.0	8.75	A
Grid current	I_g	=	2.2	2.2	2.1	1.85	A
Peak grid driving voltage	V_{gp}	=	1000	940	875	810	V
Grid driving power	W_{dr}	=	2.1	1.9	1.7	1.55	kW
Anode input power	W_{ia}	=	146	111	90	70	kW
Anode dissipation	W_a	=	26	21	18	15	kW
Output power	W_o	=	120	90	72	55	kW
Efficiency	η	=	82	81	80	78.5	%

R.F. CLASS B AMPLIFIER

LIMITING VALUES (Absolute limits)

Frequency	f		up to	10	up to	30	MHz
Anode voltage	V_a	=	max.	16	max.	12.5	kV
Anode dissipation	W_a	=	max.	60	max.	60	kW
Negative grid voltage	$-V_g$	=	max.	1000	max.	1000	V
Grid dissipation	W_g	=	max.	1.3	max.	1.3	kW
Anode current	I_a	=	max.	13	max.	13	A
Grid current	I_g	=	max.	3.3	max.	3.3	A

OPERATING CONDITIONS

Frequency	f	=	10	10	30	30	MHz
Anode voltage	V_a	=	15	15	12	12	kV
Grid voltage	V_g	=	-260	-260	-210	-210	V
Anode current	I_a	=	10.1	7.75	12.7	9.85	A
Grid current	I_g	=	2.0	1.3	3.0	1.9	A
Peak grid driving voltage	V_{gp}	=	600	520	650	520	V
Grid driving power	W_{dr}	=	1080	610	1770	880	W
Anode input power	W_{i_a}	=	151	116.3	153	118	kW
Anode dissipation	W_a	=	41	31.3	43	33	kW
Output power	W_o	=	110	85	110	85	kW
Efficiency	η	=	73	73	72	72	%

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

Frequency	f		up to	30	MHz
Anode voltage	V_a	=	max.	11.5	kV
Anode dissipation	W_a	=	max.	30	kW
Negative grid voltage	$-V_g$	=	max.	1000	V
Grid dissipation	W_g	=	max.	1.3	kW
Anode current	I_a	=	max.	9	A
Grid current	I_g	=	max.	3.3	A

OPERATING CONDITIONS

Frequency	f	=	30	30	MHz
Anode voltage	V_a	=	11	10	kV
Grid voltage	V_g	=	−480	−440	V 1)
Anode current	I_a	=	7.6	6.9	A
Grid current	I_g	=	3.1	3.1	A
Grid resistor	R_g	=	90	80	Ω
Peak grid driving voltage	V_{g_p}	=	880	810	V
Grid driving power	W_{dr}	=	2.7	2.4	kW
Anode input power	W_{i_a}	=	83.6	69	kW
Anode dissipation	W_a	=	17.6	14	kW
Output power	W_o	=	66	55	kW
Efficiency	η	=	79	79	%
Modulation depth	m	=	100	100	%
Modulation power	W_{mod}	=	41.8	34.5	kW

---

1) Partially obtained by the grid resistor and grid current.

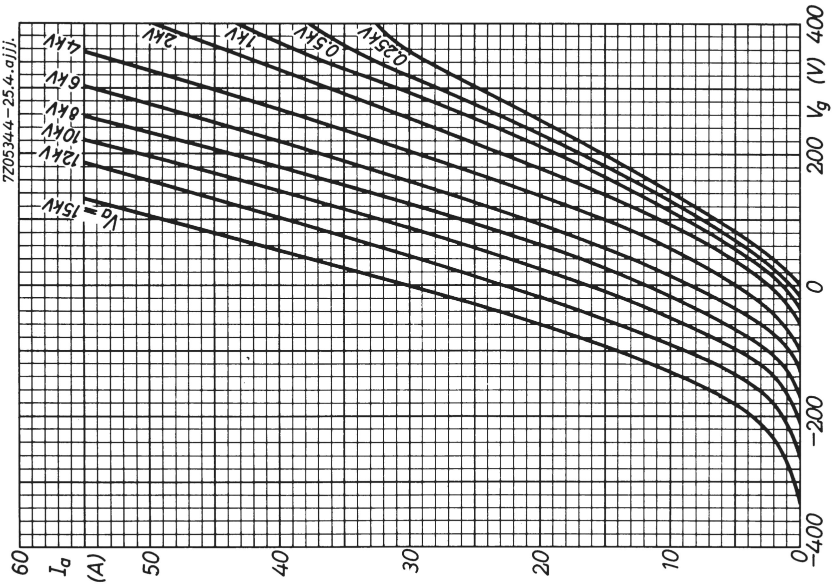
A.F. CLASS B AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	=	max.	12	kV
Anode dissipation	W_a	=	max.	60	kW
Negative grid voltage	$-V_g$	=	max.	1000	V
Grid dissipation	W_g	=	max.	1.3	kW
Anode current	I_a	=	max.	13	A
Grid current	I_g	=	max.	3.3	A

OPERATING CONDITIONS (two tubes in push-pull)

Anode voltage	V_a	=	12		10		kV
Grid voltage	V_g	=	−205		−170		V
Load resistance	$R_{aa\sim}$	=	2720		1810		Ω
Peak grid driving voltage	V_{ggp}	=	0	710	0	710	V
Anode current	I_a	=	2x0.4	2x4.75	2x0.4	2x5.75	A
Average grid current	I_g	=	0	2x0.45	0	2x0.72	A
Peak grid current	I_{gp}	=	0	2x2.9	0	2x4.0	A
Grid driving power	W_{dr}	=	0	2x150	0	2x235	W
Anode input power	W_{ia}	=	2x4.0	2x57	2x4.0	2x57.5	kW
Anode dissipation	W_a	=	2x4.0	2x18	2x4.0	2x18.5	kW
Output power	W_o	=	0	78	0	78	kW
Efficiency	η	=	–	68.5	–	68	%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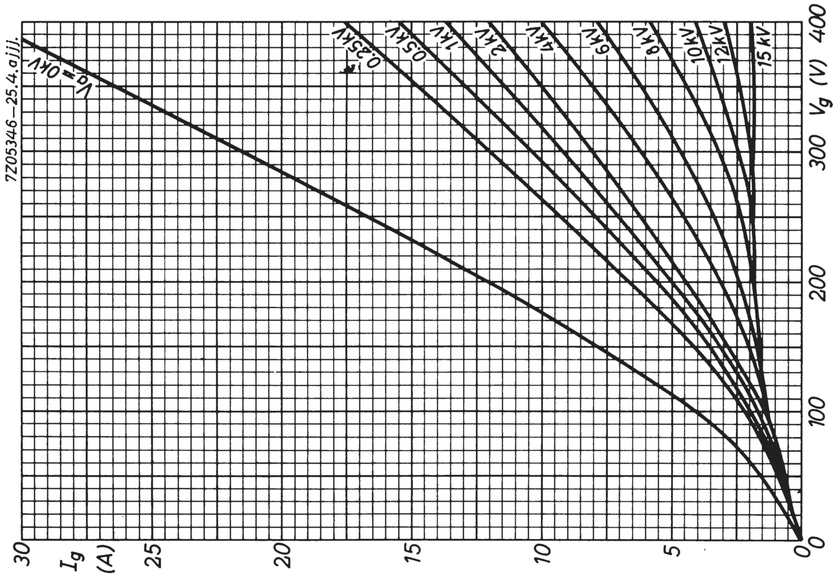
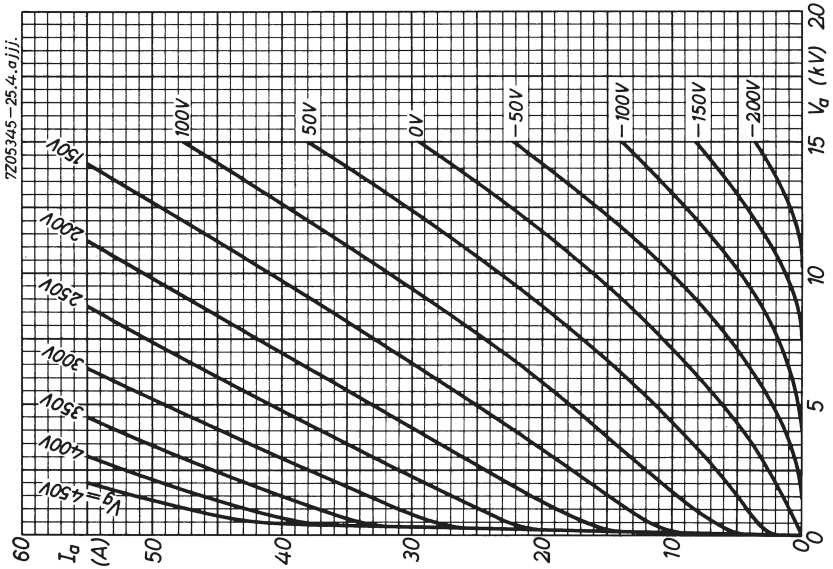
Va = 15kV
12kV
10kV
8kV
6kV
4kV
2kV
1kV
0.5kV
0.25kV
Ia (A)
60
50
40
30
20
10
0
Vg (V)
400
200
0
−200
−400


7Z05346-25.4.ajjj.
Va = 0kV
0.25kV
0.5kV
1kV
2kV
4kV
6kV
8kV
10kV
12kV
15 kV
Ig (A)
30
25
20
15
10
5
0
Vg (V)
0
100
200
300
400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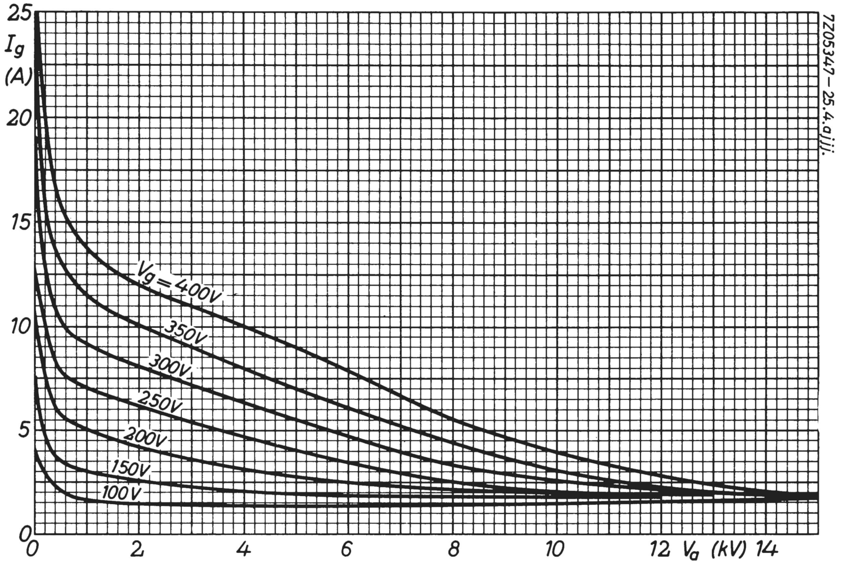
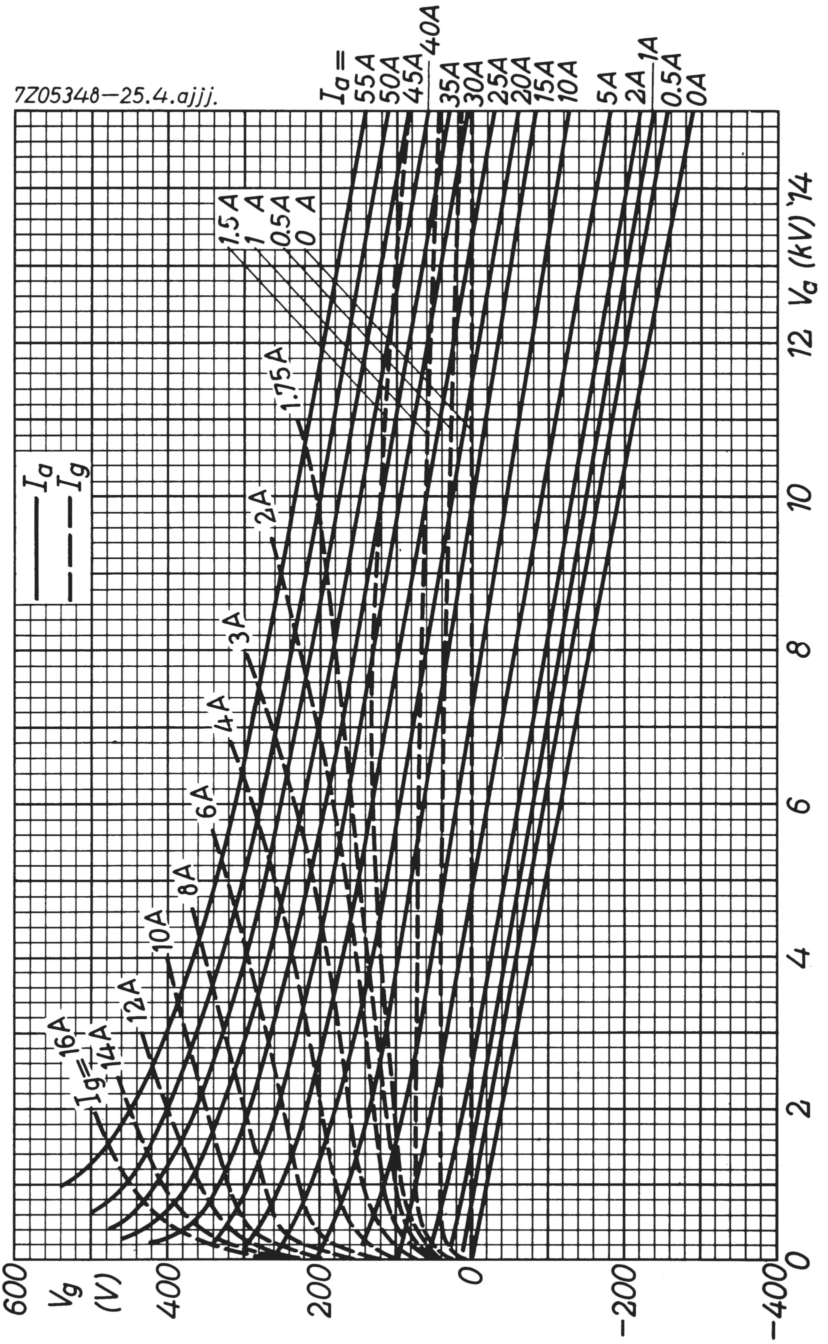
V_a (kV)
0
5
10
15
20
I_a (A)
0
10
20
30
40
50
60
V_g=450V
400V
350V
300V
250V
200V
150V
100V
50V
0V
−50V
−100V
−150V
−200V


7Z05347-25.4.ajjj.
I_g (A)
0
5
10
15
20
25
V_a (kV)
0
2
4
6
8
10
12
14
V_g=400V
350V
300V
250V
200V
150V
100V


7Z05348–25.4.ajjj.
I_a =
55A
50A
45A
40A
35A
30A
25A
20A
15A
10A
5A
2A
1A
0.5A
0A
1.5A
1 A
0.5A
0 A
1.75A
2A
3A
4A
6A
8A
10A
12A
14A
I_g = 16A
I_a
I_g
V_a (kV)
0
2
4
6
8
10
12
14
V_g (V)
600
400
200
0
−200
−400

WATER COOLED R.F. POWER TRIODE

QUICK REFERENCE DATA								
Frequency (MHz)	C telegr.		B teleph.		C an.mod.		A.F.class B[1]	
	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)
10	15	360					12	450
30	12	285	10	60	11	165	10	400
			8	50	10	135	8	300
			6	35	8	110	6	200

HEATING : direct by AC or DC; filament thoriated tungsten

Filament voltage	V_f	=	18	V
Filament current	I_f	=	280	A

CAPACITANCES

Anode to filament	C_{af}	=	7.5	pF
Grid to filament	C_{gf}	=	240	pF
Anode to grid	C_{ag}	=	120	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	4	kV
Anode current	I_a	=	5	A
Amplification factor	μ	=	55	
Mutual conductance	S	=	130	mA/V

---

[1] Two tubes

TEMPERATURE LIMITS (Absolute limits)

Bulb temperature = max. 180 °C

Seal temperature = max. 180 °C

COOLING CHARACTERISTICS . See also cooling curves

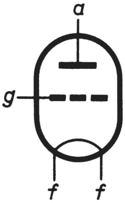
W_a (kW)	t_i (°C)	q_{min} (l/min)	p_i (atm)
10	20	12	0.003
	50	17	0.005
40	20	37	0.03
	50	54	0.07
80	20	75	0.12
	50	112	0.26
120	20	120	0.3
	50	179	0.6

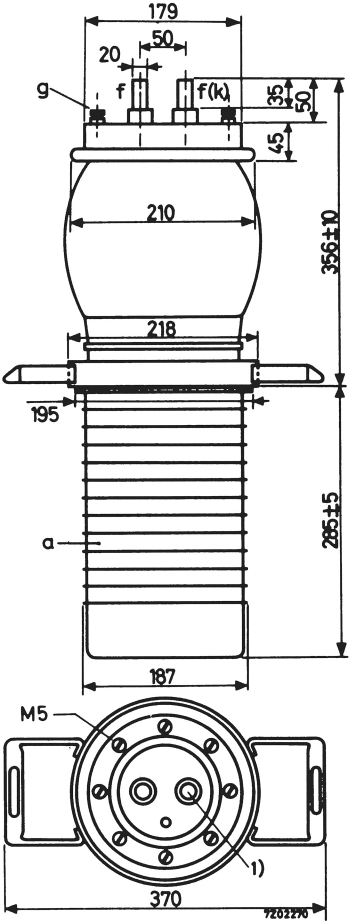
For inlet temperatures t_i between 20 °C and 50 °C the required quantity of water can be found by proportional interpolation.
At frequencies higher than 10 MHz a low velocity air flow should be directed to the seals of grid and filament.

MECHANICAL DATA

Dimensions in mm

Net weight of tube	: 32.5 kg
Net weight of water jacket	: 30.5 kg





179
50
20
g
f
f(k)
35
50
45
210
356±10
218
195
a
285±5
187
M5
1)
370
7Z02270

Mounting position: vertical with anode down

ACCESSORIES

Water jacket	: K723
Filament connectors with cable	: 40667

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[1]) This pin should be used for connecting the anode return lead.

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

Frequency	f		up to 10	up to 30	MHz
Anode voltage	V_a	= max.	15	12	kV
Anode dissipation	W_a	= max.	120	120	kW
Negative grid voltage	$-V_g$	= max.	1200	1200	V
Grid dissipation	W_g	= max.	4	4	kW
Anode current	I_a	= max.	33	33	A
Grid current	I_g	= max.	8	8	A

OPERATING CONDITIONS

Frequency	f	=	10	10	30	30	MHz
Anode voltage	V_a	=	15	15	12	12	kV
Grid voltage	V_g	=	-520	-800	-480	-720	V
Anode current	I_a	=	29.3	24.7	29.3	24.7	A
Grid current	I_g	=	5.4	5.2	5.9	5.5	A
Peak driving voltage	V_{g_p}	=	1090	1370	1050	1290	V
Driving power	W_{dr}	=	5.5	6.6	5.7	6.6	kW
Anode input power	W_{ia}	=	440	371	353	296	kW
Anode dissipation	W_a	=	80	61	68	51	kW
Output power	W_o	=	360	310	285	245	kW
Efficiency	η	=	81.8	83.5	80.8	82.6	%

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

Frequency	f		up to 30	MHz
Anode voltage	V_a	= max.	11	kV
Anode dissipation	W_a	= max.	80	kW
Negative grid voltage	$-V_g$	= max.	1000	V
Grid dissipation	W_g	= max.	4	kW
Anode current	I_a	= max.	22	A
Grid current	I_g	= max.	8	A

OPERATING CONDITIONS

Frequency	f	=	30	30	30	MHz
Anode voltage	V_a	=	11	10	8	kV
Grid voltage	V_g	=	-170	-140	-100	V
Grid resistor	R_g	=	40	44	33	Ω
Anode current	I_a	=	19	17.3	18	A
Grid current	I_g	=	7.4	6.9	7.6	A
Peak driving voltage	V_{g_p}	=	1000	930	855	V
Driving power	W_{dr}	=	7.1	6	6	kW
Anode input power	W_{ia}	=	209	173	144	kW
Anode dissipation	W_a	=	44	38	34	kW
Output power	W_o	=	165	135	110	kW
Efficiency	η	=	79	78	76.5	%
Modulation depth	m	=	100	100	100	%
Modulation power	W_{mod}	=	105	87	72	kW

R.F. CLASS B TELEPHONY

LIMITING VALUES (Absolute limits)

Frequency	f		up to 10	up to 30	MHz
Anode voltage	V_a	= max.	15	12	kV
Anode dissipation	W_a	= max.	120	120	kW
Negative grid voltage	$-V_g$	= max.	800	800	V
Grid dissipation	W_g	= max.	4	4	kW
Anode current	I_a	= max.	27	27	A
Grid current	I_g	= max.	8	8	A

OPERATING CONDITIONS

Frequency	f	=	30	30	30	MHz
Anode voltage	V_a	=	10	8	6	kV
Grid voltage	V_g	=	-150	-115	-82	V
Anode current	I_a	=	17	18.2	17.9	A
Grid current	I_g	=	0.8	1.2	1.5	A
Peak driving voltage	V_{g_p}	=	338	338	321	V
Driving power	W_{dr}	=	0.25	0.36	0.43	kW
Anode input power	W_{ia}	=	170	146	108	kW
Anode dissipation	W_a	=	110	96	73	kW
Output power	W_o	=	60	50	35	kW
Efficiency	η	=	35.3	34.3	32.6	%
Modulation depth	m	=	100	100	100	%
Grid current	I_g	=	5.9	6.8	7.2	A
Driving power	W_{dr}	=	3.6	4.1	4.1	kW

A.F. CLASS B AMPLIFIER

LIMITING VALUES (Absolute limits)

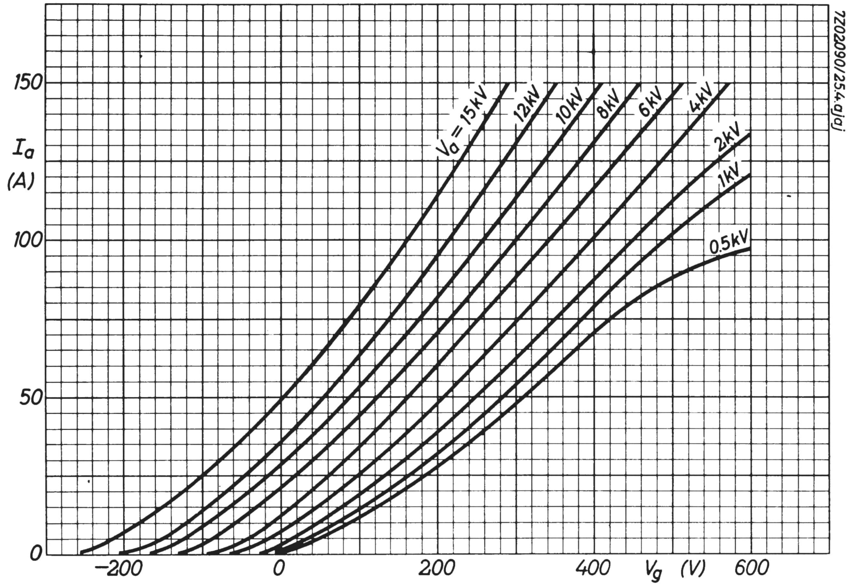
Anode voltage	V_a	= max.	12	kV
Anode dissipation	W_a	= max.	120	kW
Negative grid voltage	$-V_g$	= max.	800	V
Grid dissipation	W_g	= max.	4	kW
Anode current	I_a	= max.	33	A
Grid current	I_g	= max.	8	A

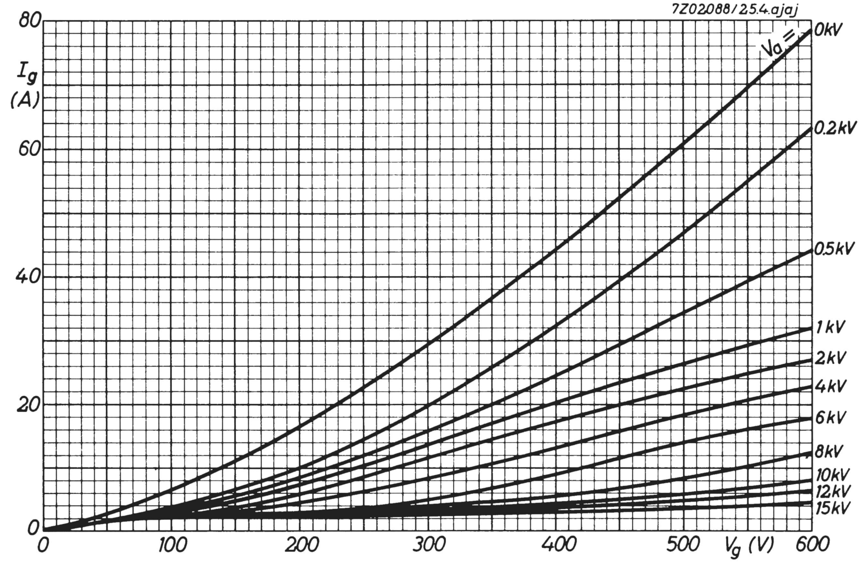
OPERATING CONDITIONS, two tubes in push-pull

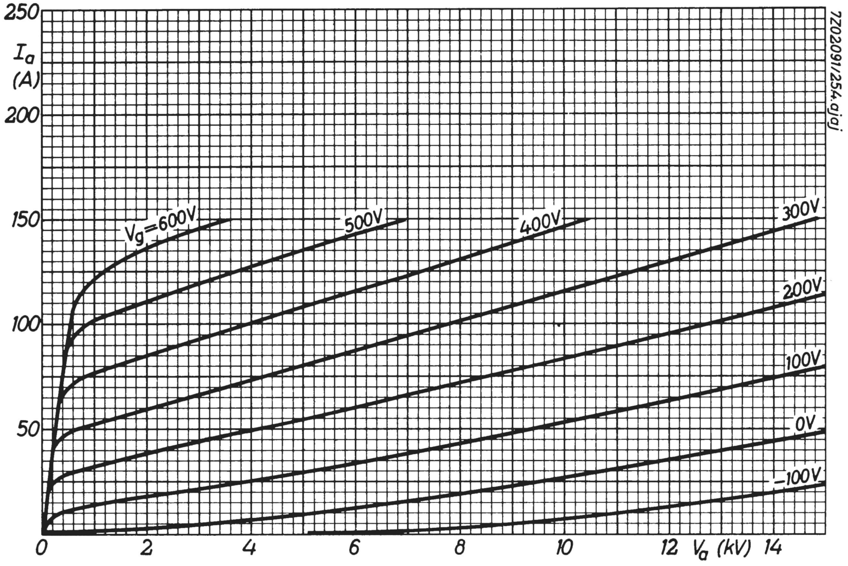
Anode voltage	V_a	=	12		10		kV
Grid voltage	V_g	=	-180		-150		V
Load resistance	$R_{aa\sim}$	=	552		410		Ω
Peak driving voltage	V_{ggp}	=	0	1210	0	1205	V
Anode current	I_a	=	2x2	2x26	2x1.8	2x28	A
Grid current	I_g	=	0	2x4.4	0	2x4.8	A
Peak grid current	$I_{g\,p}$	=	0	2x23	0	2x24	A
Driving power	W_{dr}	=	0	2x2.4	0	2x2.6	kW
Anode input power	W_{ia}	=	2x24	2x312	2x18	2x280	kW
Anode dissipation	W_a	=	2x24	2x87	2x18	2x80	kW
Output power	W_o	=	0	450	0	400	kW
Efficiency	η	=	-	72	-	71.4	%

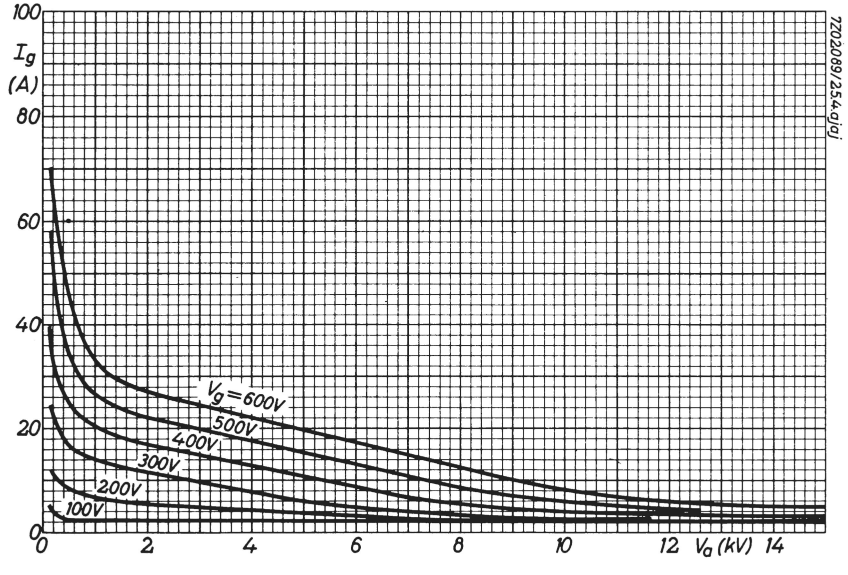
OPERATING CONDITIONS, two tubes in push-pull (continued)

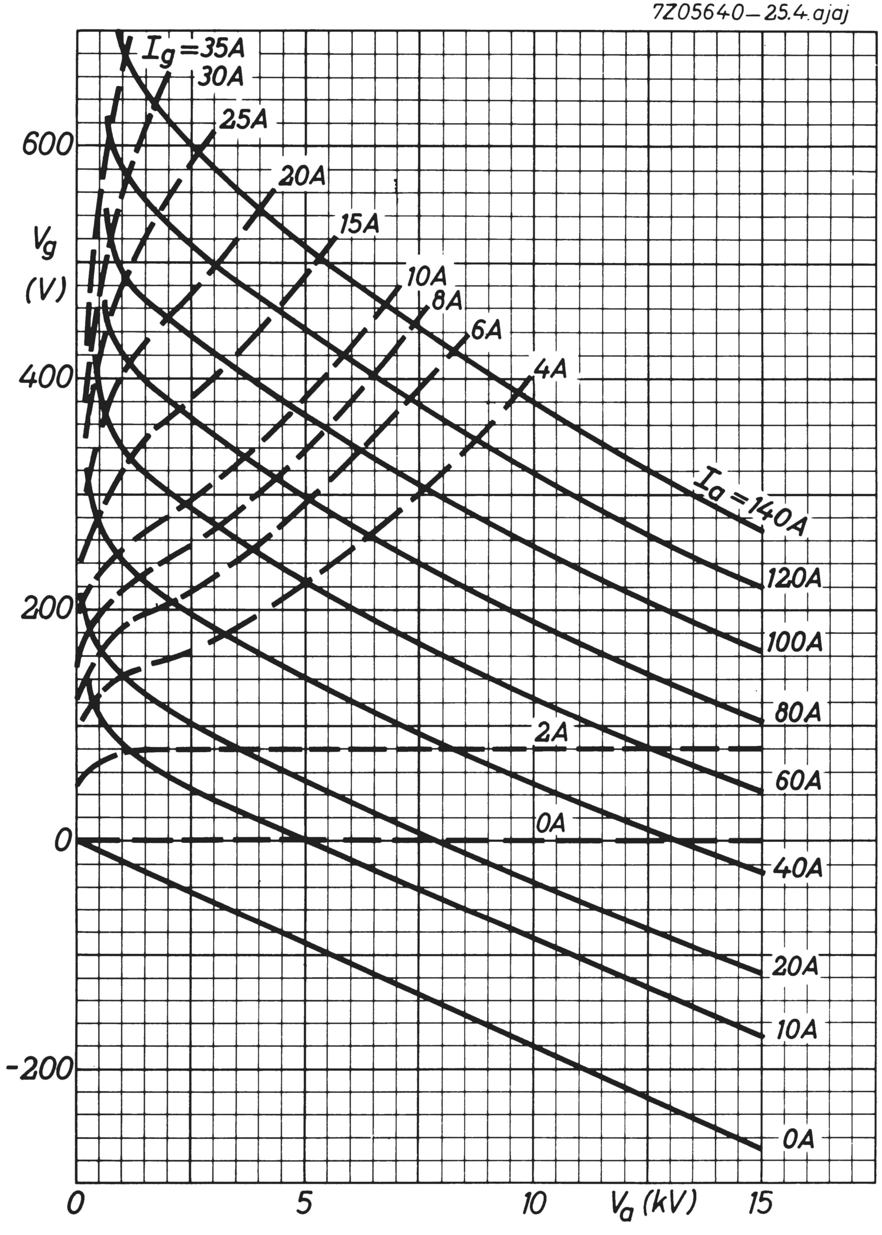
Anode voltage	V_a	=	8		6		kV
Grid voltage	V_g	=	-115		-82		V
Load resistance	$R_{aa\sim}$	=	338		268		Ω
Peak driving voltage	V_{gg_p}	=	0	1110	0	990	V
Anode current	I_a	=	2x1.6	2x27	2x1.4	2x25	A
Grid current	I_g	=	0	2x5	0	2x4.9	A
Peak grid current	I_{gp}	=	0	2x24	0	2x22	A
Driving power	W_{dr}	=	0	2x2.5	0	2x2.2	kW
Anode input power	W_{ia}	=	2x12.8	2x216	2x8.4	2x150	kW
Anode dissipation	W_a	=	2x12.8	2x66	2x8.4	2x50	kW
Output power	W_o	=	0	300	0	200	kW
Efficiency	η	=	-	69.5	-	67	%

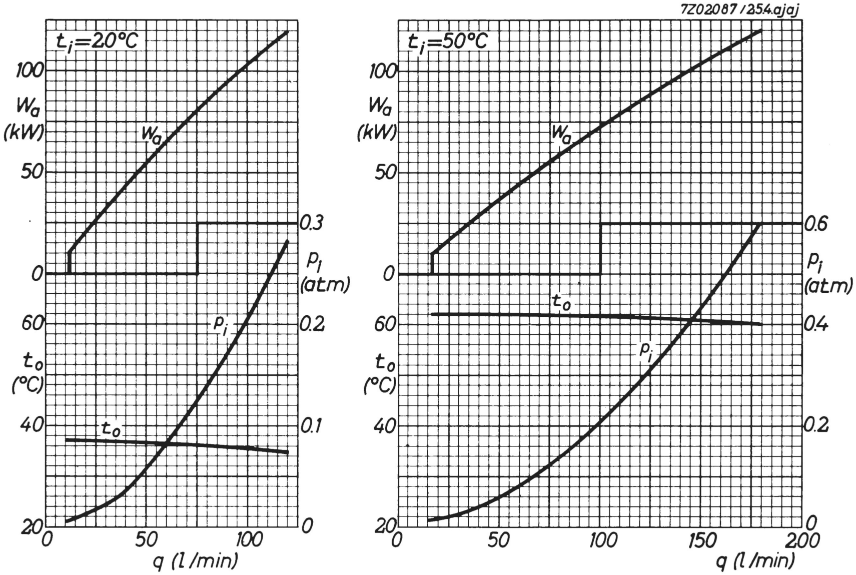

7Z02090/25.4.ajaj
150
I_a
(A)
100
50
0
V_a = 15kV
12kV
10kV
8kV
6kV
4kV
2kV
1kV
0.5kV
−200
0
200
400
V_g (V)
600


7Z02088/25.4.ajaj
80
I_g
(A)
60
40
20
0
V_a = 0kV
0.2kV
0.5kV
1kV
2kV
4kV
6kV
8kV
10kV
12kV
15kV
0
100
200
300
400
500
V_g (V)
600


250
I_a
(A)
200
150
100
50
0
2
4
6
8
10
12
V_a (kV)
14
V_g=600V
500V
400V
300V
200V
100V
0V
−100V
7Z02091/254.ajaj


100
I_g
(A)
80
60
40
20
0
0
2
4
6
8
10
12
V_a (kV)
14
V_g=600V
500V
400V
300V
200V
100V
7Z02089/254.ajaj


7Z05640–25.4.ajaj
I_g=35A
30A
25A
20A
15A
10A
8A
6A
4A
2A
0A
I_a=140A
120A
100A
80A
60A
40A
20A
10A
0A
V_g
(V)
600
400
200
0
-200
0
5
10
V_a (kV)
15


7Z02087/254.ajaj
$t_i = 20°C$
$t_i = 50°C$
W_a (kW)
100
50
0
W_a
p_i (atm)
0.3
0.2
0.1
0
0.6
0.4
0.2
0
p_i
t_o (°C)
60
40
20
t_o
q (l/min)
0
50
100
150
200

VAPOUR COOLED R.F. POWER TRIODE

QUICK REFERENCE DATA								
Frequency (MHz)	C telegraphy		C anode mod.		B telephony		AF class B Two tubes	
	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)
10	15	360					12	450
30	12	285	11	165	10	60	10	400
			10	135	8	50	8	300
			8	110	6	35	6	200

HEATING: direct by A.C. or D.C.; filament thoriated tungsten

Filament voltage	V_f	=	18	V
Filament current	I_f	=	280	A

CAPACITANCES

Grid to filament	C_{gf}	=	240	pF
Anode to filament	C_{af}	=	7.5	pF
Anode to grid	C_{ag}	=	120	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	4	kV
Anode current	I_a	=	5	A
Amplification factor	μ	=	55	
Mutual conductance	S	=	130	mA/V

TEMPERATURE LIMITS (Absolute limits)

Bulb temperature	t	=	max. 180	^{o}C
Seal temperature	t	=	max. 180	^{o}C

COOLING

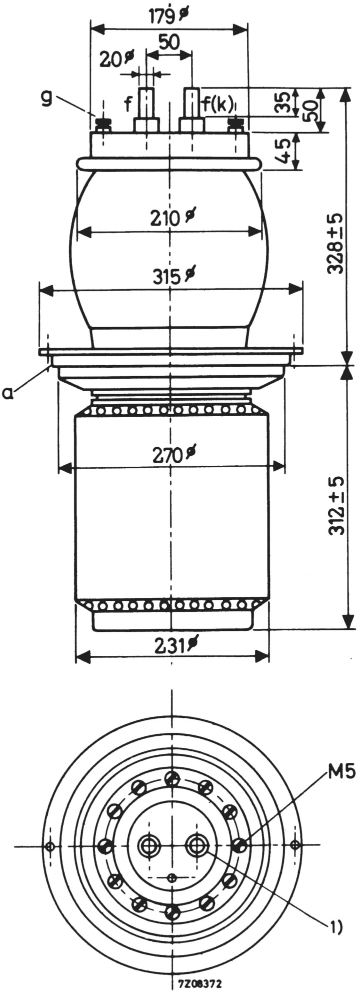
Cooling data for anode dissipation $W_a = 180$ kW

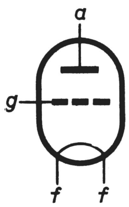
Total dissipation to be transferred by cooling system $(W_a + W_g + 0.8\ W_f)$	188	kW
equivalent to	2700	kcal/min
Volume of produced vapour		
at back flow water temperature of 20 °C	7.3	m^3/min
at back flow water temperature of 90 °C	8.3	m^3/min
Amount of back flowing water		
at back flow water temperature of 20 °C	4.4	l/min
at back flow water temperature of 90 °C	5.1	l/min

MECHANICAL DATA

Net weight: 51.5 kg

Dimensions in mm


179ø
50
20ø
g
f
f(k)
35
50
45
210ø
315ø
328±5
a
270ø
312±5
231ø
M5
1)
7Z08372



Mounting position: vertical with anode down

ACCESSORIES

Vapour cooling system	K729
Filament connectors with cable	40667

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[1] This pin should be used for connecting the anode return lead

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

Frequency	f		up to 10	up to 30	MHz
Anode voltage	V_a	= max.	15	12	kV
Anode dissipation	W_a	= max.	180	180	kW
Negative grid voltage	$-V_g$	= max.	1200	1200	V
Grid dissipation	W_g	= max.	4	4	kW
Anode current	I_a	= max.	33	33	A
Grid current	I_g	= max.	8	8	A

OPERATING CONDITIONS

Frequency	f	=	10	10	30	30	MHz
Anode voltage	V_a	=	15	15	12	12	kV
Grid voltage	V_g	=	-520	-800	-480	-720	V
Anode current	I_a	=	29.3	24.7	29.3	24.7	A
Grid current	I_g	=	5.4	5.2	5.9	5.5	A
Peak driving voltage	V_{gp}	=	1090	1370	1050	1290	V
Driving power	W_{dr}	=	5.5	6.6	5.7	6.6	kW
Anode input power	W_{ia}	=	440	371	353	296	kW
Anode dissipation	W_a	=	80	61	68	51	kW
Output power	W_{α}	=	360	310	285	245	kW
Efficiency	η	=	81.8	83.5	80.8	82.6	%

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

Frequency	f		up to	30	MHz
Anode voltage	V_a	=	max.	11	kV
Anode dissipation	W_a	=	max.	120	kW
Negative grid voltage	$-V_g$	=	max.	1000	V
Grid dissipation	W_g	=	max.	4	kW
Anode current	I_a	=	max.	22	A
Grid current	I_g	=	max.	8	A

OPERATING CONDITIONS

Frequency	f	=	30	30	30	MHz
Anode voltage	V_a	=	11	10	8	kV
Grid voltage	V_g	=	-170	-140	-100	V
Grid resistor	R_g	=	40	44	33	Ω
Anode current	I_a	=	19	17.3	18	A
Grid current	I_g	=	7.4	6.9	7.6	A
Peak driving voltage	V_{gp}	=	1000	930	855	V
Driving power	W_{dr}	=	7.1	6.0	6.0	kW
Anode input power	W_{ia}	=	209	173	144	kW
Anode dissipation	W_a	=	44	38	34	kW
Output power	W_o	=	165	135	110	kW
Efficiency	η	=	79	78	76.5	%
Modulation depth	m	=	100	100	100	%
Modulation power	W_{mod}	=	105	87	72	kW

R.F. CLASS B TELEPHONY

LIMITING VALUES (Absolute limits)

Frequency	f		up to 10	up to 30	MHz
Anode voltage	V_a	=	max. 15	12	kV
Anode dissipation	W_a	=	max. 180	180	kW
Negative grid voltage	$-V_g$	=	max. 800	800	V
Grid dissipation	W_g	=	max. 4	4	kW
Anode current	I_a	=	max. 27	27	A
Grid current	I_g	=	max. 8	8	A

OPERATING CONDITIONS

Frequency	f	=	30	30	30	MHz
Anode voltage	V_a	=	10	8	6	kV
Grid voltage	V_g	=	-150	-115	-82	V
Anode current	I_a	=	17	18.2	17.9	A
Grid current	I_g	=	0.8	1.2	1.5	A
Peak driving voltage	V_{gp}	=	338	338	321	V
Driving power	W_{dr}	=	0.25	0.36	0.43	kW
Anode input power	W_{i_a}	=	170	146	108	kW
Anode dissipation	W_a	=	110	96	73	kW
Output power	W_o	=	60	50	35	kW
Efficiency	η	=	35.3	34.3	32.6	%
Modulation depth	m	=	100	100	100	%
Grid current	I_g	=	5.9	6.8	7.2	A
Driving power	W_{dr}	=	3.6	4.1	4.1	kW

A.F. CLASS B AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	=	max.	12	kV
Anode dissipation	W_a	=	max.	180	kW
Negative grid voltage	$-V_g$	=	max.	800	V
Grid dissipation	W_g	=	max.	4	kW
Anode current	I_a	=	max.	33	A
Grid current	I_g	=	max.	8	A

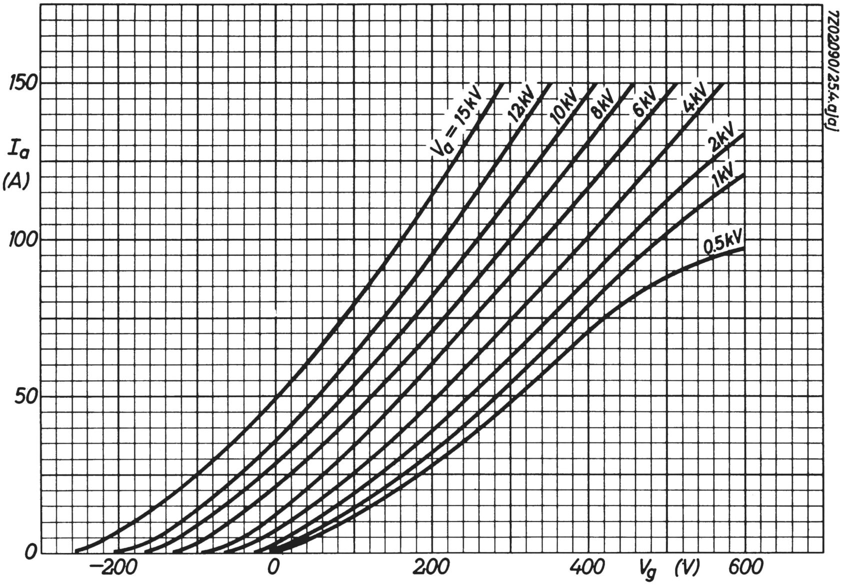
OPERATING CONDITIONS (Two tubes in push-pull)

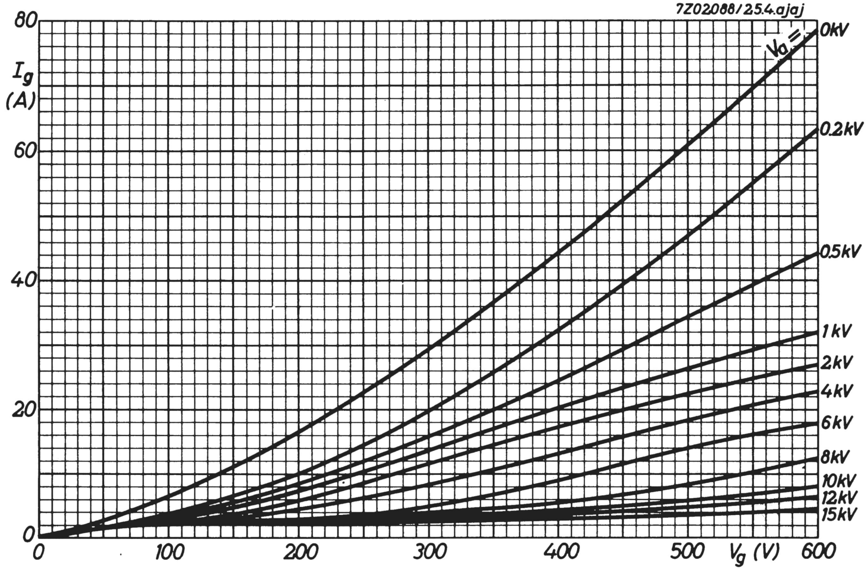
Anode voltage	V_a	=	12		10		kV
Grid voltage	V_g	=	-180		-150		V
Load resistance	$R_{aa\sim}$	=	552		410		Ω
Peak driving voltage	V_{gg_p}	=	0	1210	0	1205	V
Anode current	I_a	=	2x2.0	2x26	2x1.8	2x28	A
Average grid current	I_g	=	0	2x4.4	0	2x4.8	A
Peak grid current	I_{g_p}	=	0	2x23	0	2x24	A
Driving power	W_{dr}	=	0	2x2.4	0	2x2.6	kW
Anode input power	W_{i_a}	=	2x24	2x312	2x18	2x280	kW
Anode dissipation	W_a	=	2x24	2x87	2x18	2x80	kW
Output power	W_o	=	0	450	0	400	kW
Efficiency	η	=	-	72	-	71.4	%

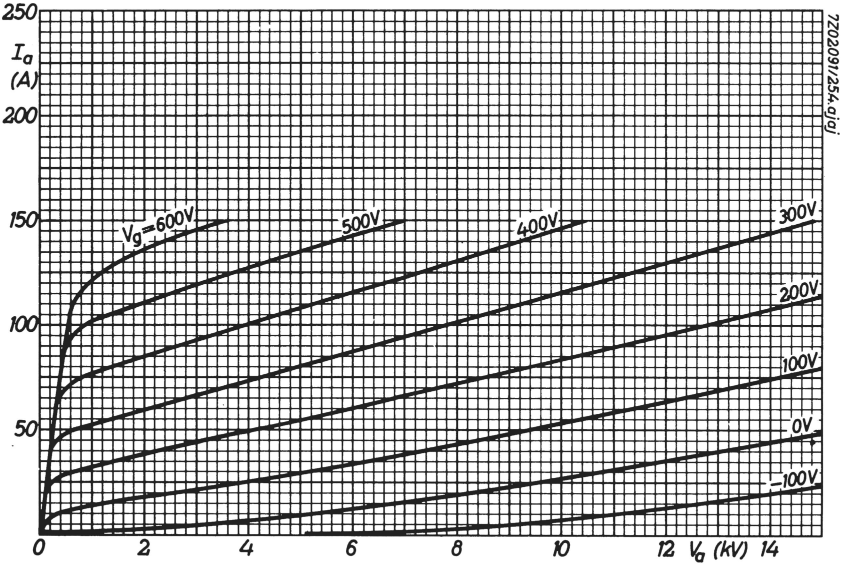
A.F. CLASS B AMPLIFIER AND MODULATOR

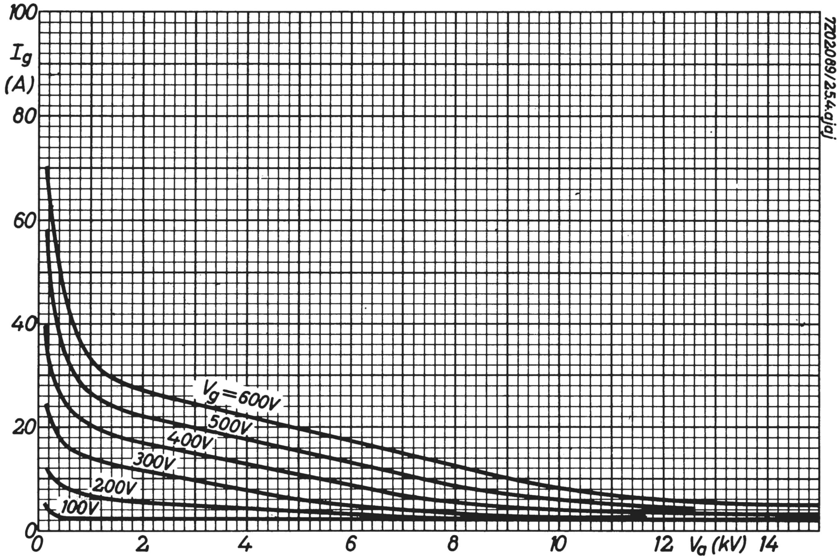
OPERATING CONDITIONS (Two tubes in push-pull; continued)

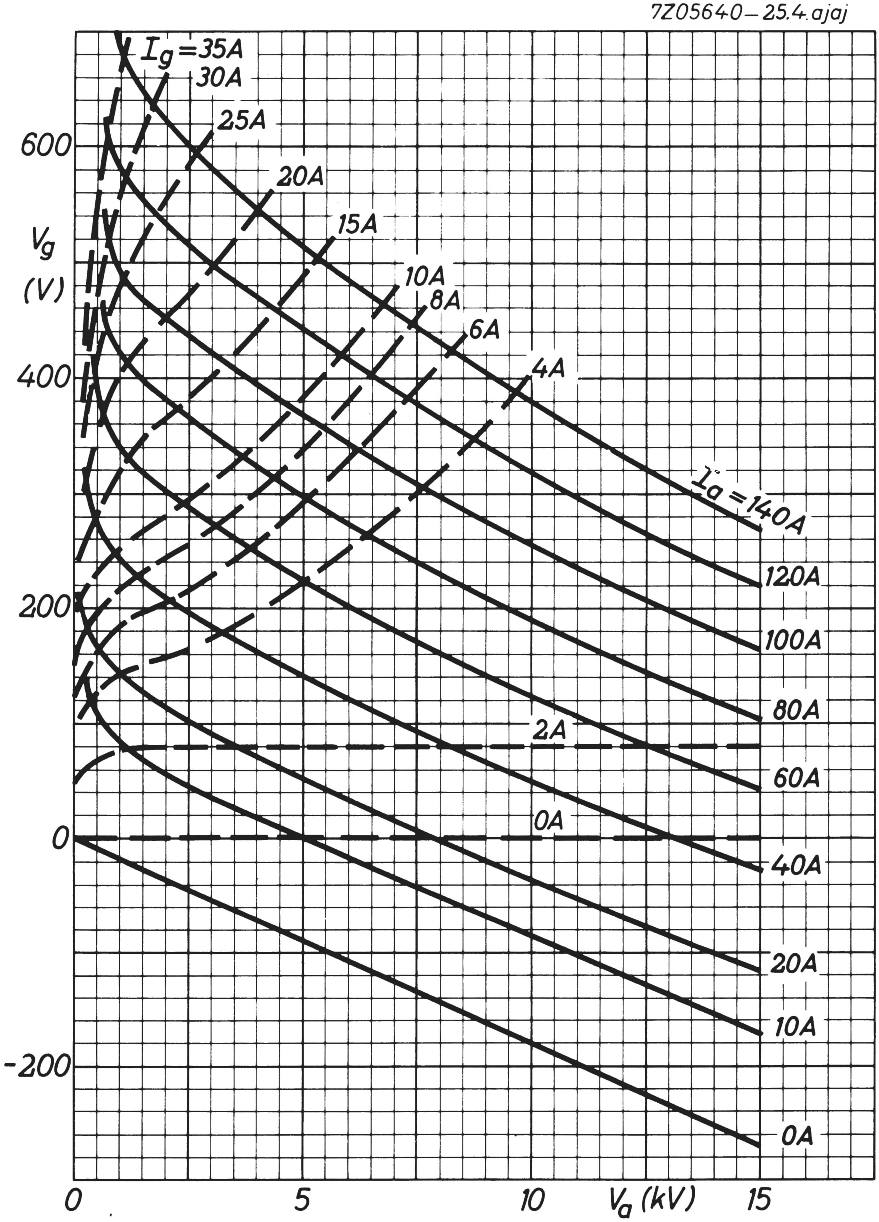
Anode voltage	V_a	=	8		6		kV
Grid voltage	V_g	=	-115		-82		V
Load resistance	$R_{aa\sim}$	=	338		268		Ω
Peak driving voltage	V_{ggp}	=	0	1110	0	990	V
Anode current	I_a	=	2x1.6	2x27	2x1.4	2x25	A
Average grid current	I_g	=	0	2x5.0	0	2x4.9	A
Peak grid current	I_{gp}	=	0	2x24	0	2x22	A
Driving power	W_{dr}	=	0	2x2.5	0	2x2.2	kW
Anode input power	W_{ia}	=	2x12.8	2x216	2x8.4	2x150	kW
Anode dissipation	W_a	=	2x12.8	2x66	2x8.4	2x50	kW
Output power	W_o	=	0	300	0	200	kW
Efficiency	η	=	-	69.5	-	67	%


7Z02090/25.4.ajaj
150
I_a
(A)
100
50
0
−200
0
200
400
V_g (V)
600
V_a = 15 kV
12kV
10kV
8kV
6kV
4kV
2kV
1kV
0.5kV


7Z02088/25.4.ajaj
80
I_g
(A)
60
40
20
0
0
100
200
300
400
500
V_g (V)
600
V_a = 0kV
0.2kV
0.5kV
1kV
2kV
4kV
6kV
8kV
10kV
12kV
15kV


250
I_a
(A)
200
150
100
50
V_g=600V
500V
400V
300V
200V
100V
0V
−100V
0
2
4
6
8
10
12
V_a (kV)
14
7Z02091/254.ajaj


100
I_g
(A)
80
60
40
20
0
V_g=600V
500V
400V
300V
200V
100V
0
2
4
6
8
10
12
V_a (kV)
14
7Z02089/254.ajaj


7Z05640—25.4.ajaj
I_g=35A
30A
25A
20A
15A
10A
8A
6A
4A
2A
0A
I_a=140A
120A
100A
80A
60A
40A
20A
10A
0A
600
400
200
0
-200
V_g (V)
0
5
10
15
V_a (kV)

AIR COOLED R.F. POWER TRIODE

QUICK REFERENCE DATA								
Frequency (MHz)	C telegraphy		C anode mod.		C television Two tubes		AF class B Two tubes	
	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)
30	4	4.0					6	13.3
	5	5.6						
	6	6.9						
75			5	4.7				
110	5	4.8	4	2.8				
220	3	2.65						
48 to 75					5	9.5		

HEATING: direct; filament thoriated tungsten

Filament voltage V_f = 12.6 V

Filament current I_f = 33 A

The connection f_c is intended for use as cathode return. It is not an electrical centre tap and must not be used for filament current supply. At frequencies above 30 MHz the three filament leads should be interconnected by suitable capacitors.

CAPACITANCES

Anode to filament C_{af} = 0.3 pF

Grid to filament C_{gf} = 16 pF

Anode to grid C_{ag} = 11 pF

TYPICAL CHARACTERISTICS

Anode voltage V_a = 4.0 kV

Anode current I_a = 1.0 A

Amplification factor μ = 32

Mutual conductance S = 17 mA/V

TEMPERATURE LIMITS (Absolute limits)

Temperature of anode and grid seals	t	=	max.	180	°C
Temperature of pin seals	t	=	max.	220	°C
Air inlet temperature	t_i	=	max.	45	°C

AIR COOLING CHARACTERISTICS

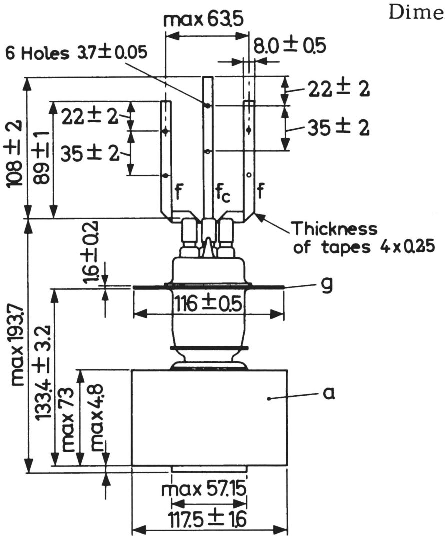
W_a (kW)	h (m)	t_i (°C)	q_{min} (m^3/min)	p_i (mm H_2O)
1	0	35	3.0	8
	0	45	3.1	8
	1500	35	3.7	9
	3000	25	4.1	10
3	0	35	5.2	23
	0	45	6.1	29
	1500	35	6.2	26
	3000	25	6.6	26
5	0	35	9.2	68
	0	45	10.7	90
	1500	35	11.2	81
	3000	25	11.6	79

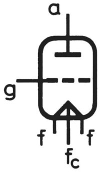
It may be necessary to direct an air flow to the seals to keep them within the temperature limits.

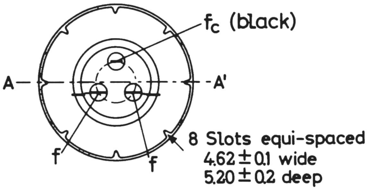
MECHANICAL DATA

Dimensions in mm

Net weight: 3.4 kg


max 63.5
6 Holes 3.7 ± 0.05
8.0 ± 0.5
22 ± 2
35 ± 2
22 ± 2
35 ± 2
108 ± 2
89 ± 1
f
f_c
f
Thickness of tapes 4 x 0.25
1.6 ± 0.2
g
116 ± 0.5
max 193.7
133.4 ± 3.2
max 73
max 4.8
a
max 57.15
117.5 ± 1.6




f_c (black)
A
A'
8 Slots equi-spaced
4.62 ± 0.1 wide
5.20 ± 0.2 deep
f
f

The plane of the filament is parallel to AA' to within $3\frac{1}{2}^{\circ}$

Mounting position: vertical with base up or down

R.F. CLASS C TELEGRAPHY or F.M. TELEPHONY

LIMITING VALUES (Absolute limits)

Frequency	f		up to 75	110	220	MHz
Anode voltage	V_a	= max.	6.2	5.5	4.0	kV
Anode current	I_a	= max.	1.5	1.5	1.5	A
Anode input power	W_{ia}	= max.	9.3	8.2	6.0	kW
Anode dissipation	W_a	= max.	5.0	5.0	5.0	kW
Negative grid voltage	$-V_g$	= max.	1000	1000	1000	V
Grid current	I_g	= max.	350	350	350	mA

OPERATING CONDITIONS

Frequency	f	=	30	30	30	110	220[1]	MHz
Anode voltage	V_a	=	6.0	5.0	4.0	5.0	3.0	kV
Grid voltage	V_g	=	−400	−300	−200	−300	−160	V
Anode current	I_a	=	1.5	1.5	1.37	1.25	1.25	A
Grid current	I_g	=	310	330	300	300	250	mA
Driver output power	W_{dr}	=	275	240	190	250	510	W
Anode input power	W_{ia}	=	9.0	7.5	5.5	6.25	3.75	kW
Anode dissipation	W_a	=	2.1	1.9	1.5	1.45	1.6	kW
Output power	W_o	=	6.9	5.6	4.0	4.8	2.65	kW
Tube efficiency	η	=	76.5	75	73	77	70	%
Output power in the load	W_ℓ	=	5.5	4.5	3.2	3.9	2.15	kW

---

1) In grounded grid circuit

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

Frequency	f		up to 75	110	220	MHz
Anode voltage	V_a	=	max. 5.0	4.5	3.2	kV
Anode current	I_a	=	max. 1.3	1.3	1.3	A
Anode input power	W_{i_a}	=	max. 6.5	5.8	4.0	kW
Anode dissipation	W_a	=	max. 3.4	3.4	3.4	kW
Negative grid voltage	$-V_g$	=	max. 1000	1000	1000	V
Grid current	I_g	=	max. 350	350	350	mA

OPERATING CONDITIONS

Frequency	f	=	75	110	MHz
Anode voltage	V_a	=	5.0	4.0	kV
Grid voltage	V_g	=	-400	-350	V
Anode current	I_a	=	1.2	0.93	A
Grid current	I_g	=	300	240	mA
Driver output power	W_{dr}	=	205	130	W
Anode input power	W_{i_a}	=	6.0	3.72	kW
Anode dissipation	W_a	=	1.3	0.92	kW
Output power	W_o	=	4.7	2.8	kW
Tube efficiency	η	=	78.5	75	%
Output power in the load	W_ℓ	=	3.75	2.25	kW
Modulation depth	m	=	100	100	%
Modulation power	W_{mod}	=	2.4	1.4	kW

R.F. CLASS C AMPLIFIER FOR TELEVISION SERVICE ; negative modulation, positive synchronisation

LIMITING VALUES (Absolute limits)

Frequency	f		up to 75	up to 220	MHz
Anode voltage	V_a	=	max. 5.0	max. 4.0	kV
Anode current	I_a sync	=	max. 2.0	max. 1.6	A
Anode input power	W_{i_a}	=	max. 10	max. 6.4	kW
Anode dissipation	W_a sync	=	max. 4.0	max. 4.0	kW
Negative grid voltage	$-V_g$ sync	=	max. 1000	max. 1000	V
Grid dissipation	W_g sync	=	max. 120	max. 120	W

OPERATING CONDITIONS (Two tubes in push-pull, common cathode bias modulated)

Frequency	f		=	48 to 75	MHz
Bandwidth (– 3 dB)	B		=	8.0	MHz
Anode voltage	V_a		=	5.0	kV
Grid voltage	V_g	sync	=	-200	V
	V_g	black	=	-300	V
	V_g	white	=	-550	V
Anode current	I_a	sync	=	2x1.9	A
	I_a	black	=	2x1.3	A
Grid current	I_g	sync	=	2x250	mA
	I_g	black	=	2x175	mA
Driver output power	W_{dr}	sync	=	250	W
Output power	W_o	sync	=	9.5	kW
Output power in the load	W_ℓ	sync	=	6.3	kW

A.F. CLASS B AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	=	max.	6.0	kV
Anode current	I_a	=	max.	1.8	A
Anode input power	W_{ia}	=	max.	10.5	kW
Anode dissipation	W_a	=	max.	5.0	kW

OPERATING CONDITIONS (Two tubes in push-pull)

Anode voltage	V_a	=	6.0		kV
Grid voltage	V_g	=	-165		V [1]
Load resistance	$R_{aa\sim}$	=	4.9		kΩ
Grid driving voltage	V_{gg}	=	0	645	V(RMS)
Anode current	I_a	=	2x125	2x1500	mA
Grid current	I_g	=	0	2x280	mA
Driving power	W_{dr}	=	0	2x115	W
Anode input power	W_{ia}	=	2x0.75	2x9.0	kW
Anode dissipation	W_a	=	2x0.75	2x2.35	kW
Output power	W_o	=	0	13.3	kW
Efficiency	η	=	-	74	%
Total harmonic distortion	d_{tot}	=	-	4.3	%

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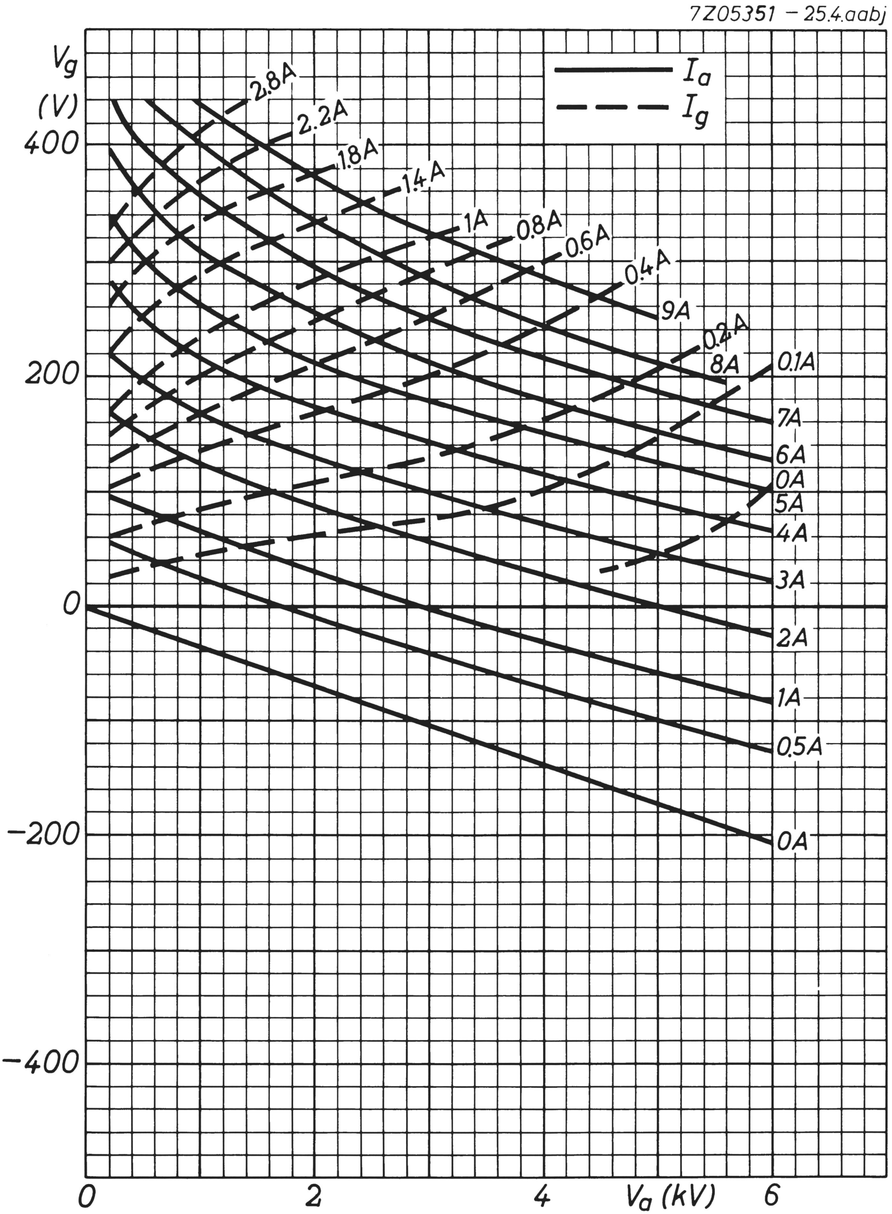
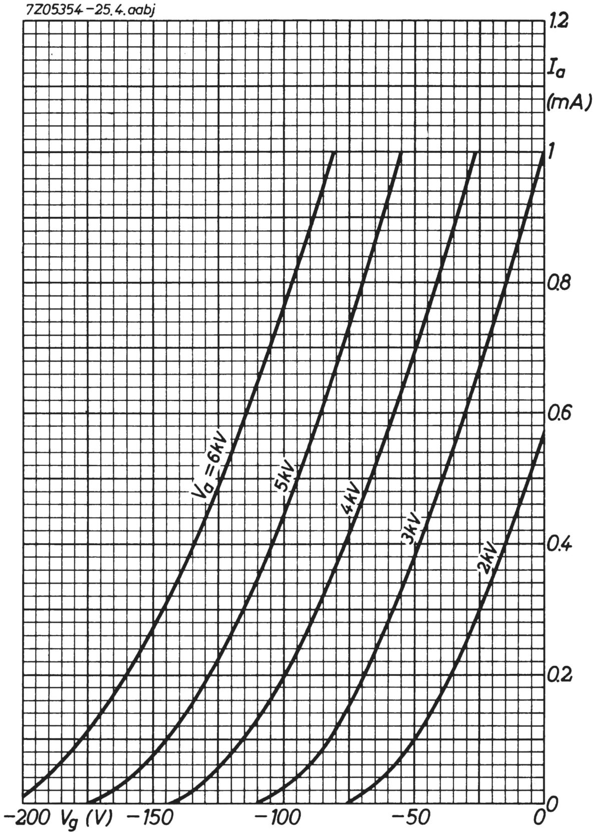
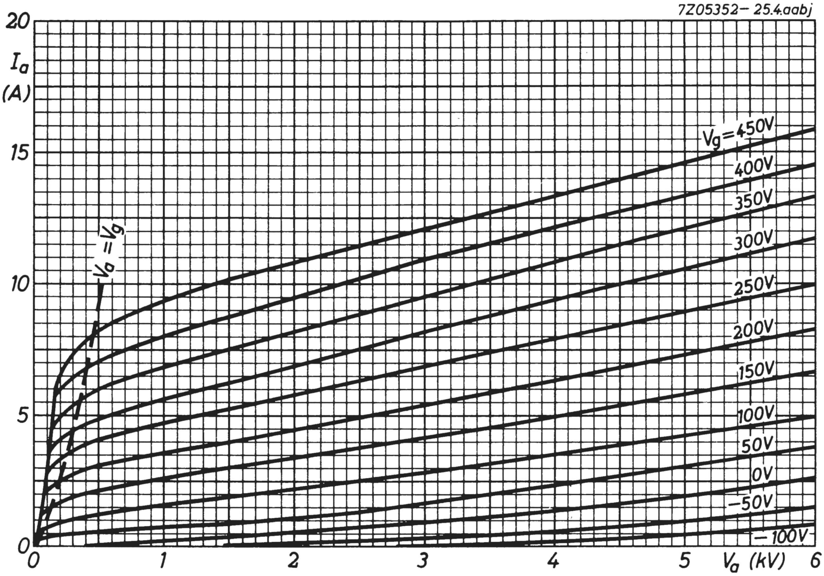
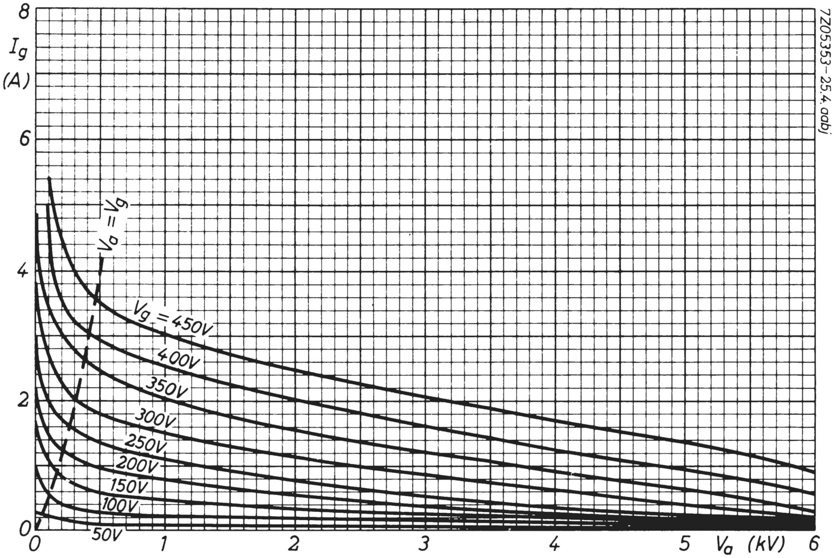
[1] To be adjusted for zero signal anode current of 125 mA.


7Z05351 – 25.4.aabj
V_g (V)
400
200
0
−200
−400
0
2
4
V_a (kV)
6
I_a
I_g
2.8A
2.2A
1.8A
1.4A
1A
0.8A
0.6A
0.4A
0.2A
0.1A
0A
9A
8A
7A
6A
5A
4A
3A
2A
1A
0.5A
0A


7Z05354-25.4.aabj
1.2
I_a
(mA)
1
0.8
0.6
0.4
0.2
0
V_a = 6kV
5kV
4kV
3kV
2kV
-200 V_g (V) -150
-100
-50
0


7Z05352– 25.4.aabj
20
I_a
(A)
15
10
5
0
$V_a = V_g$
V_g=450V
400V
350V
300V
250V
200V
150V
100V
50V
0V
–50V
–100V
0
1
2
3
4
5
V_a (kV)
6


7Z05353– 25.4.aabj
8
I_g
(A)
6
4
2
0
$V_a = V_g$
V_g = 450V
400V
350V
300V
250V
200V
150V
100V
50V
0
1
2
3
4
5
V_a (kV)
6

R.F. POWER TRIODE

R.F. zero bias power triode intended for use as linear S.S.B. amplifier and A.F. class B amplifier

QUICK REFERENCE DATA				
Class B SSB			B mod. Two tubes	
Frequency (MHz)	V_a (V)	W_{load} (PEP) (W)	V_a (V)	W_o (W)
30	2500	580	3000	1310

HEATING: direct by A.C. or D.C.; filament thoriated tungsten

Filament voltage	V_f	=	5.0	V
Filament current	I_f	=	14.1	A

CAPACITANCES

Anode to filament	C_{af}	=	0.033	pF
Grid to filament	C_{gf}	=	8.0	pF
Anode to grid	C_{ag}	=	5.0	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	5	kV
Anode current	I_a	=	80	mA
Mutual conductance	S	=	11	mA/V
Amplification factor	μ	=	350	

TEMPERATURE LIMITS (Absolute limits)

Anode seal temperature	t	=	max. 220	°C
Pin seal temperature	t	=	max. 180	°C
Bulb temperature	t	=	max. 350	°C

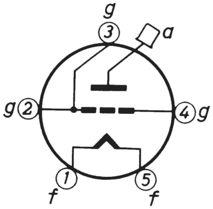
COOLING

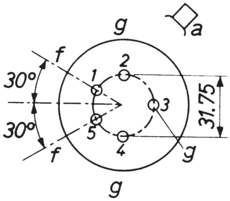
Radiation and low velocity air flow

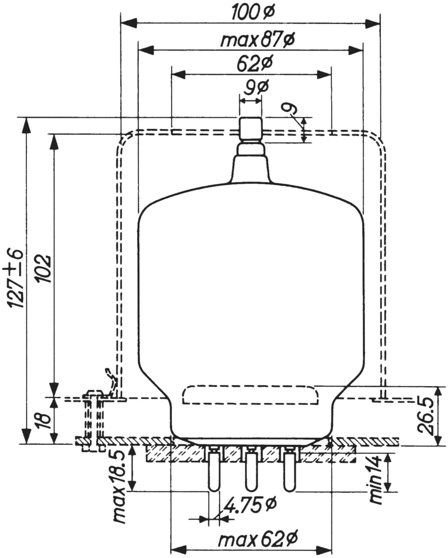
MECHANICAL DATA

Net weight: 210 g

Base : Giant 5p.


g
3
a
g 2
4 g
1
5
f
f


g
a
f
30°
30°
f
1
2
3
4
5
31.75
g
g


100⌀
max 87⌀
62⌀
9⌀
9
127±6
102
18
26.5
max 18.5
min 14
4.75⌀
max 62⌀

Dimensions in mm

Mounting suggestion of
tube with chimney

Mounting position: vertical with base up or down

In order to prevent overheating of the grid pins by high-frequency current it is recommended to include the three grid socket connections in the circuit.

ACCESSORIES

Anode connector	40624
Socket	2422 512 01001
Chimney	40666

R. F. CLASS B LINEAR POWER AMPLIFIER SINGLE SIDE BAND

suppressed carrier, zero bias, grounded grid

LIMITING VALUES (Absolute limits)

Frequency	f		up to 110	MHz
Anode voltage	V_a	=	max. 3000	V
Anode input power	W_{i_a}	=	max. 1200	W
Anode dissipation	W_a	=	max. 400	W
Anode current	I_a	=	max. 400	mA
Grid dissipation	W_g	=	max. 20	W

OPERATING CHARACTERISTICS

Frequency	f	=	30			MHz
Anode voltage	V_a	=	2500			V
Grid voltage	V_g	=	0			V
			zero signal	single tone signal	double tone signal	
Peak cathode driving voltage	V_{kp}	=	0	91	91	V
Anode current	I_a	=	72	400	270	mA
Grid current	I_g	=	–	140	80	mA
Driver output power	W_{dr}	=	–	35	35 (PEP)	W
Anode input power	W_{i_a}	=	180	1000	675	W
Anode dissipation	W_a	=	180	385	368	W
Output power	W_o	=	0	640¹)	640 (PEP)²)	W
Output power in load	W_{load}	=	0	580	580 (PEP)	W³)
Overall efficiency	η	=	–	58	43	%
Intermodulation distortion						
of the 3rd order	d_3	=	–	–	–29	dB⁴)
of the 5th order	d_5	=	–	–	–34	dB⁴)

---

1) Inclusive 25 W feedthrough power

2) Inclusive 25 W peak envelope feedthrough power

3) Measured in a circuit having an efficiency of 91 %

4) Maximum distortion level encountered at any driving level up to full drive, referred to the amplitude of either of the two tones in a double tone test signal at full drive.

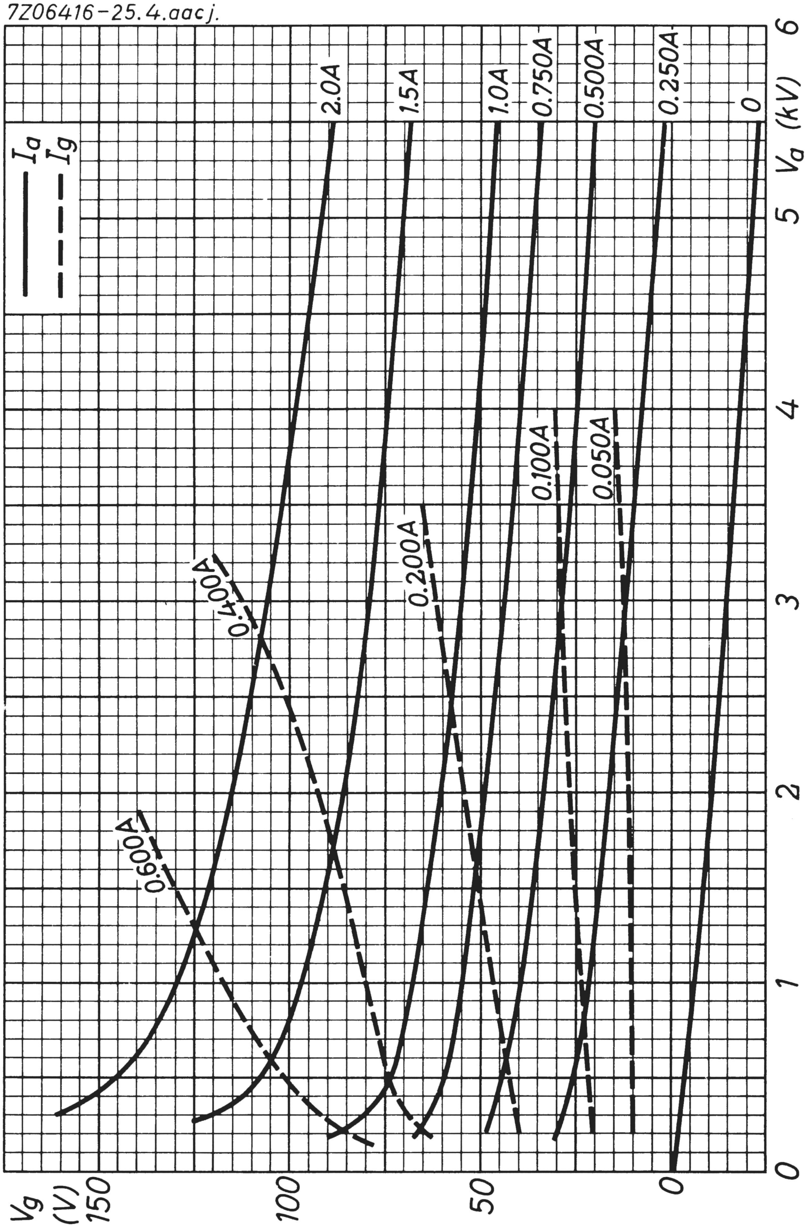
A.F. CLASS B AMPLIFIER AND MODULATOR

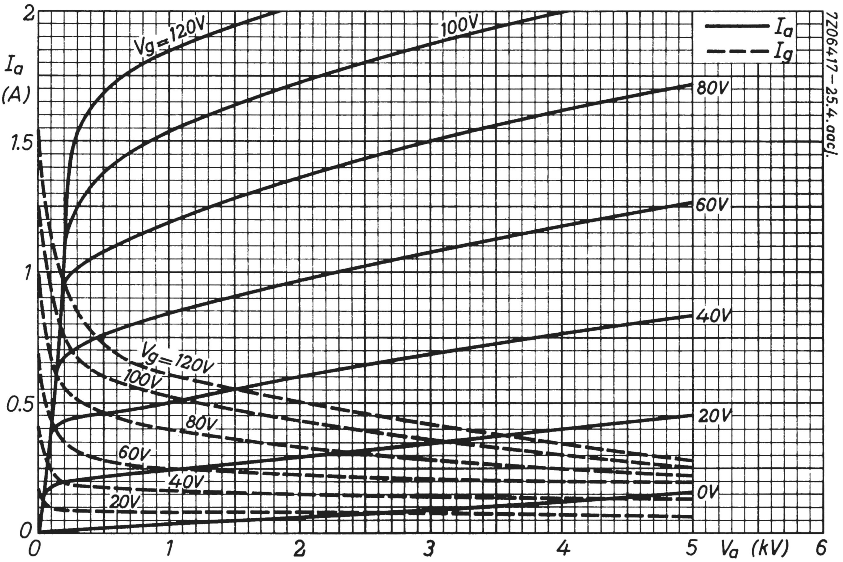
LIMITING VALUES (Absolute limits)

Anode voltage	V_a	=	max.	3000	V
Anode input power	W_{ia}	=	max.	1200	W
Anode dissipation	W_a	=	max.	400	W
Anode current	I_a	=	max.	400	mA
Grid dissipation	W_g	=	max.	20	W

OPERATING CONDITIONS Class B, two tubes in push-pull

Anode voltage	V_a	=	3000		V
Load resistance	$R_{aa\sim}$	=	9500		Ω
Peak grid driving voltage	V_{ggp}	=	0	176	V
Anode current	I_a	=	2x90	2x333	mA
Grid current	I_g	=	0	2x120	mA
Driving power	W_{dr}	=	0	26	W
Anode input power	W_{ia}	=	2x270	2x1000	W
Anode dissipation	W_a	=	2x270	2x345	W
Output power	W_o	=	0	1310	W
Efficiency	η	=	–	65	%


7Z06416-25.4.aacj.
I_a
I_g
V_a (kV)
6
5
4
3
2
1
0
V_g (V)
150
100
50
0
2.0A
1.5A
1.0A
0.750A
0.500A
0.250A
0
0.600A
0.400A
0.200A
0.100A
0.050A


Ia
(A)
2
1.5
1
0.5
0
Vg=120V
100V
80V
60V
40V
20V
0V
Vg=120V
100V
80V
60V
40V
20V
Ia
Ig
7Z06417 – 25.4.aacl.
0
1
2
3
4
5
Va (kV)
6

WATER COOLED R.F. POWER TRIODE

QUICK REFERENCE DATA								
Freq. (MHz)	C telegr.		C an. mod.		C industr. osc.		B mod [1]	
	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)
30	12	108	10	83	12	124	10	106
	10	75	10	58	12	108	10	64
					10	75		

HEATING: direct; filament thoriated tungsten

Filament voltage V_f = 17.5 V

Filament current I_f = 196 A

Filament peak current I_{fp} max. 420 A

Cold filament resisrance R_{fo} = 0.012 Ω

CAPACITANCES

Anode to all other elements except grid C_a = 2.2 pF

Grid to all other elements except anode C_g = 122 pF

Anode to grid C_{ag} = 75 pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	3	10	kV
Anode current	I_a	=	50	5	A
Amplification factor	μ	=	25	25	
Mutual conductance	S	=	140	60	mA/V

---

[1] Two tubes

TEMPERATURE LIMITS (Absolute limits)

Water inlet temperature t_i = max. 50 °C

Temperature of seals = max. 180 °C

WATER COOLING CHARACTERISTICS ; see also cooling curves

W_a (kW)	t_i (°C)	q_{min} (l/min)	p_i (atm)
30	20	25	0.15
	50	45	0.45
50	20	32	0.25
	50	65	0.85
100	20	55	0.6
	50	120	3.0

At water inlet temperatures between 20 and 50 °C the required quantity of water can be found by linear interpolation.

At frequencies below 6 MHz forced air cooling of the seals will, as a rule, not be necessary. Above 6 MHz air cooling must be used to keep the anode and grid seal temperatures below 180 °C. The seals can be cooled by connecting a blower of suitable size to the air inlet of the anti-corona ring, attached to the tube.
At maximum frequency (30 MHz) and published operating conditions an air flow of 2.5 m^3/minute with a pressure loss of about 500 mm H_2O will in general be sufficient. The air flow must be started upon or before the application of filament voltage.

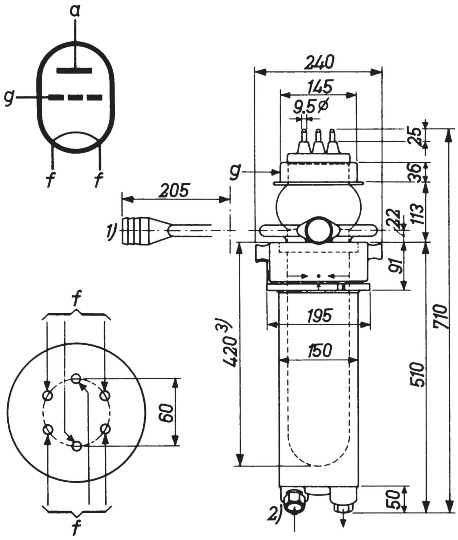
When using the special filament connectors type No. 40628, together with connecting leads of adequate cross-section, additional air cooling of the filament terminals is, as a rule, not necessary.

Care should be taken to ensure firm contact of the filament terminals in order to obtain equal distribution of current over these terminals.

MECHANICAL DATA

Dimensions in mm

Water-jacket	: K714	Net weight of tube	: 14 kg
Filament connectors	: 40628	Net weight of water-jacket	: 20.5 kg
O-ring	: 2622 080 31817		


a
g
f
f
240
145
9.5⌀
25
36
113
22
g
205
1)
91
195
150
420 3)
510
710
50
2)
60
f
f

Mounting position: vertical with anode down

When connecting the filament the three pins of each group must be joined.

---

[1] Use connecting hose with an inner diameter of 1¾".

[2] Coupling for metal tubing with an outer diameter of 28 mm.

[3] For removing the tube from its water-jacket the free height above the tube must be at least 420 mm.

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

Frequency	f	up to	4	15	30	MHz
Anode voltage	V_a	= max.	15	13.5	12.5	kV
Anode current	I_a	= max.	12.5	12.5	12.5	A
Anode input power	W_{ia}	= max.	165	165	150	kW
Anode dissipation	W_a	= max.	100	100	100	kW
Negative grid voltage	$-V_g$	= max.	1200	1200	1200	V
Grid current	I_g	= max.	1.2	1.2	1.2	A

OPERATING CONDITIONS

Frequency	f	=	30	30	MHz
Anode voltage	V_a	=	12	10	kV
Grid voltage	V_g	=	-1000	-800	V
Grid driving voltage	V_{gp}	=	1500	1200	V
Anode current	I_a	=	12	10	A
Grid current	I_g	=	0.75	0.75	A
Anode input power	W_{ia}	=	144	100	kW
Anode dissipation	W_a	=	36	25	kW
Driving power	W_{dr}	=	1100	850	W
Output power	W_o	=	108	75	kW
Efficiency	η	=	75	75	%

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

Frequency	f		up to	30	MHz
Anode voltage	V_a	=	max.	10.5	kV
Anode current	I_a	=	max.	10.5	A
Anode input power	W_{i_a}	=	max.	110	kW
Anode dissipation	W_a	=	max.	66	kW
Negative grid voltage	$-V_g$	=	max.	1200	V
Grid current	I_g	=	max.	1.3	A

OPERATING CONDITIONS

Frequency	f	=	30	30	MHz
Anode voltage	V_a	=	10	10	kV
Grid voltage	V_g	=	-1050	-1050	V [1]
Grid driving voltage	V_{g_p}	=	1550	1450	V
Anode current	I_a	=	10.5	7.4	A
Grid current	I_g	=	1.1	0.8	A
Anode input power	W_{i_a}	=	105	74	kW
Anode dissipation	W_a	=	22	16	kW
Driving power	W_{dr}	=	1650	1100	W
Output power	W_o	=	83	58	kW
Efficiency	η	=	79	79	%
Modulation depth	m	=	100	100	%
Modulation power	W_{mod}	=	53	37	kW

---

[1] Grid bias partly obtained by a grid resistor

R.F. CLASS C OSCILLATOR for industrial use with anode voltage from three-phase rectifier without filter

LIMITING VALUES (Absolute limits)

Frequency	f	up to	30	MHz
Anode voltage	V_a	= max.	13	kV
Anode current	I_a	= max.	15	A
Anode input power	W_{i_a}	= max.	180	kW
Anode dissipation	W_a	= max.	100	kW
Negative grid voltage	$-V_g$	= max.	1600	V
Grid current, loaded	I_g	= max.	1.0	A
Grid current, unloaded	I_g	= max.	1.4	A
Grid circuit resistance	R_g	= max.	10	kΩ

OPERATING CONDITIONS

Frequency	f	=	30	30	30	MHz
Anode voltage	V_a	=	12	12	10	kV
Anode current	I_a	=	14	12	10	A
Grid current	I_g	=	0.9	0.75	0.75	A
Grid circuit resistance	R_g	=	1100	1350	1100	Ω
Feedback ratio	$V_{g\sim}/V_{a\sim}$	=	15	14	14	%
Anode input power	W_{i_a}	=	168	144	100	kW
Anode dissipation	W_a	=	44	36	25	kW
Output power	W_o	=	124	108	75	kW
Efficiency	η	=	74	75	75	%
Output power in the load	W_ℓ	=	104	91	63	kW 1)

---

1) Useful power in the load measured in a circuit having an efficiency of 85%.

A.F. CLASS B AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute limits)

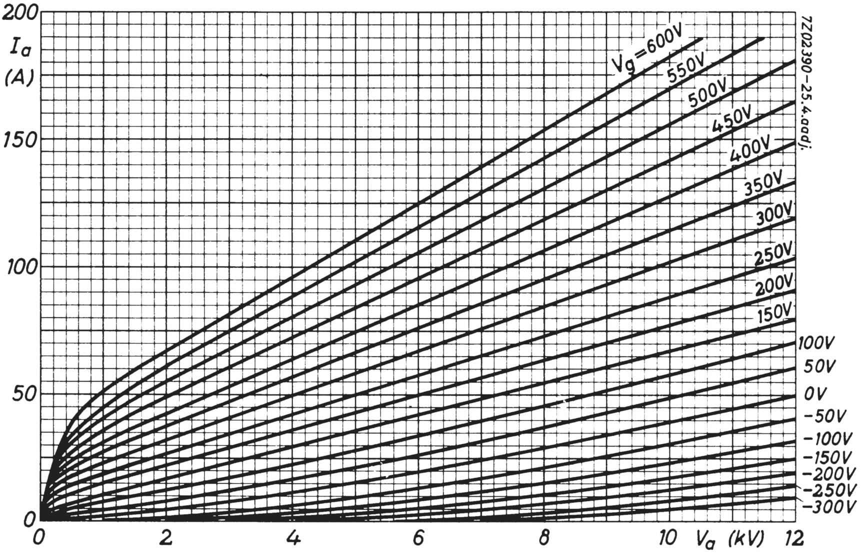
Anode voltage	V_a	= max.	15	kV
Anode current	I_a	= max.	12	A
Anode input power	W_{i_a}	= max.	162	kW
Anode dissipation	W_a	= max.	100	kW
Negative grid voltage	$-V_g$	= max.	1200	V
Grid current	I_g	= max.	1.2	A

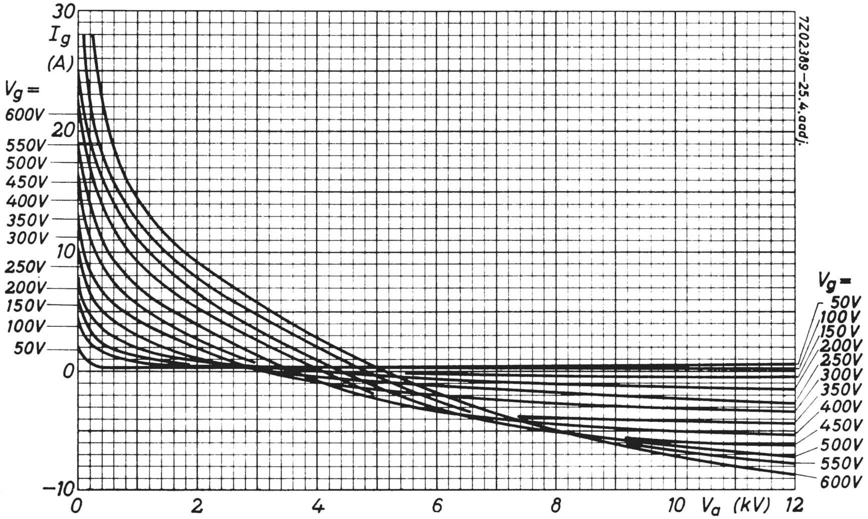
OPERATING CONDITIONS, two tubes in push-pull

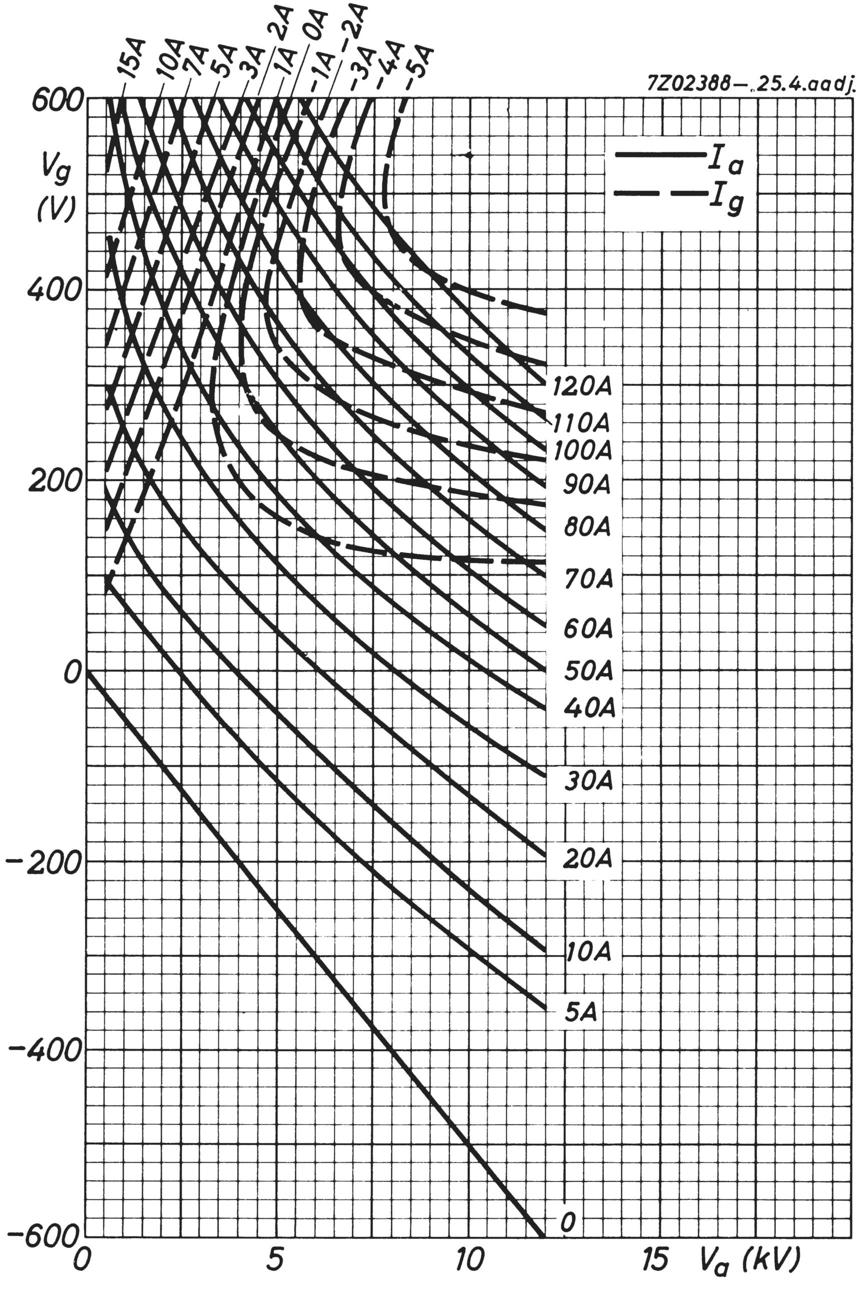
Anode voltage	V_a	=	10		10		kV
Grid voltage	V_g	=	-540		-540		V[1]
Load resistance	$R_{aa\sim}$	=	1360		1440		Ω
Driving voltage	V_{gg_p}	=	0	1550	0	1300	V
Anode current	I_a	=	2x0.3	2x8	2x0.3	2x5.8	A
Grid current	I_g	=	0	2x0.2	0	2x0.15	A
Anode input power	W_{i_a}	=	2x3	2x80	2x3	2x58	kW
Anode dissipation	W_a	=	2x3	2x27	2x3	2x26	kW
Driving power	W_{dr}	=	0	2x150	0	2x100	W
Output power	W_o	=	0	106	0	64	kW
Efficiency	η	=	–	67	–	56	%

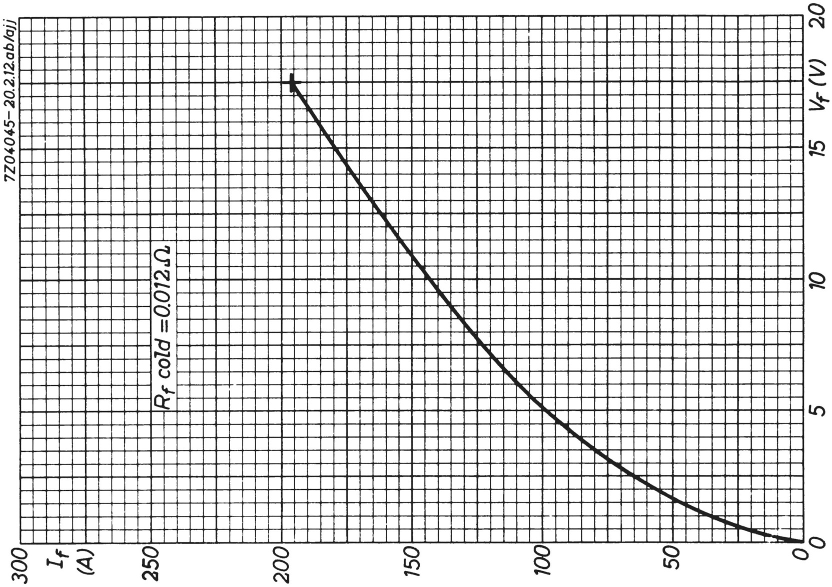
---

[1] To be adjusted for a zero signal anode current of 0.3 A

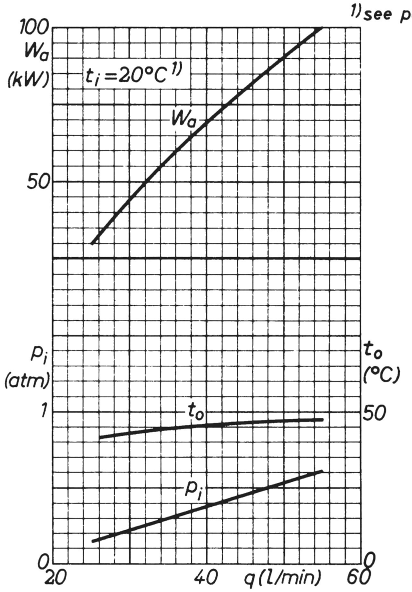

200
I_a
(A)
150
100
50
0
0
2
4
6
8
10
V_a (kV)
12
V_g=600V
550V
500V
450V
400V
350V
300V
250V
200V
150V
100V
50V
0V
-50V
-100V
-150V
-200V
-250V
-300V
7Z02390-25.4.aad.

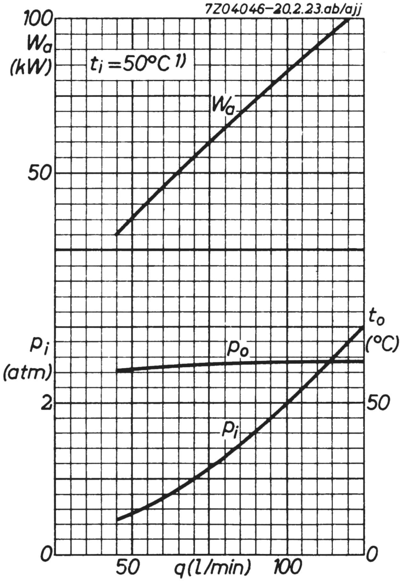

30
I_g
(A)
V_g=
600V
20
550V
500V
450V
400V
350V
300V
10
250V
200V
150V
100V
50V
0
−10
0
2
4
6
8
10
V_a (kV)
12
V_g=
50V
100V
150V
200V
250V
300V
350V
400V
450V
500V
550V
600V
7Z02389-25.4.aad.


7Z02388—.25.4.aadj.
600
400
200
0
−200
−400
−600
Vg
(V)
0
5
10
15
Va (kV)
Ia
Ig
15A
10A
7A
5A
3A
2A
1A
0A
−1A
−2A
−3A
−4A
−5A
120A
110A
100A
90A
80A
70A
60A
50A
40A
30A
20A
10A
5A
0


7Z04045–20.2.12.ab/ajj
R_f cold = 0.012 Ω
I_f (A)
300
250
200
150
100
50
0
V_f (V)
20
15
10
5
0

1) see page 2


100
W_a (kW)
50
t_i = 20°C 1)
W_a
p_i (atm)
1
0
t_o
p_i
t_o (°C)
50
0
20
40
q (l/min)
60


7Z04046–20.2.23.ab/ajj
100
W_a (kW)
50
t_i = 50°C 1)
W_a
p_i (atm)
2
0
p_o
p_i
t_o (°C)
50
0
50
q (l/min)
100

AIR COOLED R.F. POWER TRIODE

QUICK REFERENCE DATA								
Freq. (MHz)	C telegr.		C an. mod.		C industr. osc.		B mod [1]	
	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)
30	12	108	10	83	12	124	10	106
	10	75	10	58	12	108	10	64
					10	75		

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	17.5	V
Filament current	I_f	=	196	A
Filament peak current	I_{f_p}	max.	420	A
Cold filament resistance	R_{f_o}	=	0.012	Ω

CAPACITANCES

Anode to all other elements except grid	C_a	=	2.2	pF
Grid to all other elements except anode	C_g	=	122	pF
Anode to grid	C_{ag}	=	75	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	3	10	kV
Anode current	I_a	=	50	5	A
Amplification factor	μ	=	25	25	
Mutual conductance	S	=	140	60	mA/V

---

[1] Two tubes

TEMPERATURE LIMITS (Absolute limits)

Temperature of all seals = max. 180 °C

AIR COOLING CHARACTERISTICS ; see also cooling curves

W_a (kW)	h (m)	t_i (°C)	q_{min} (m^3/min)	p_i (mm H_2O)
30	0	35	35	114
	0	45	40	143
	1500	35	42	136
	3000	25	44	132
45	0	35	54	275
	0	45	62.5	335
	1500	35	64.5	322
	3000	25	68	319

When the tube is used at frequencies above 6 MHz special attention must be paid to the anode and grid seal temperatures. For frequencies below 20 MHz cooling of these seals can be effected by air flowing through the slots at the top of the cooler. In certain cases, e.g. at low dissipation and cooling with the minimum quantity of air (according to the cooling curves), the air flow to the seals will not be sufficient to maintain the seal temperatures below 180 °C. In these cases and also if it is preferred to close the slots, cooling of the seals should be effected by a separate air flow to the seals.

When using the filament connectors type 40628, together with connecting leads of adequate cross-section, additional air cooling of the filament terminals is, as a rule, not necessary.

Care should be taken to ensure firm contact of the filament terminals in order to obtain equal distribution of current over these terminals.

MECHANICAL DATA

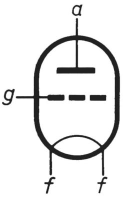
Dimensions in mm

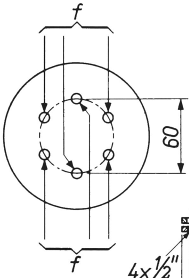
Filament connectors: 40628

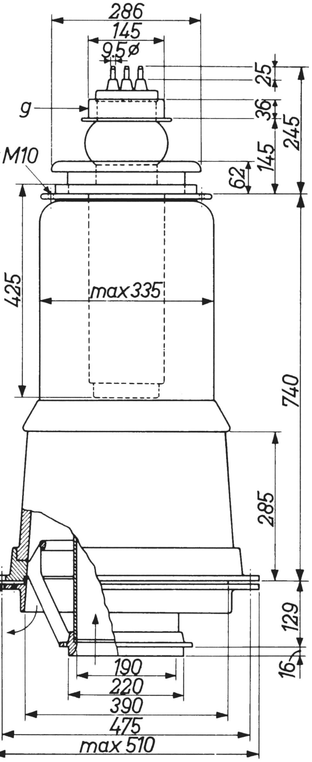
Cooler housing : K506

Net weight of tube : 28.5 kg

Net weight of K506 : 72 kg






286
145
9.5ø
g
6xM10
25
36
145
245
62
425
max 335
740
285
4x½"
129
16
190
220
390
475
max 510

Tube mounted in cooler housing type K506

Mounting position: vertical with anode down

When connecting the filament the three pins of each group must be joined.

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

Frequency	f		up to	4	15	30	MHz
Anode voltage	V_a	=	max.	15	13.5	12.5	kV
Anode current	I_a	=	max.	12.5	12.5	12.5	A
Anode input power	W_{i_a}	=	max.	165	165	150	kW
Anode dissipation	W_a	=	max.	45	45	45	kW
Negative grid voltage	$-V_g$	=	max.	1200	1200	1200	V
Grid current	I_g	=	max.	1.2	1.2	1.2	A

OPERATING CONDITIONS

Frequency	f	=	30	30	MHz
Anode voltage	V_a	=	12	10	kV
Grid voltage	V_g	=	-1000	-800	V
Grid driving voltage	V_{gp}	=	1500	1200	V
Anode current	I_a	=	12	10	A
Grid current	I_g	=	0.75	0.75	A
Anode input power	W_{ia}	=	144	100	kW
Anode dissipation	W_a	=	36	25	kW
Driving power	W_{dr}	=	1100	850	W
Output power	W_o	=	108	75	kW
Efficiency	η	=	75	75	%

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

Frequency	f		up to	30	MHz
Anode voltage	V_a	=	max.	10.5	kV
Anode current	I_a	=	max.	10.5	A
Anode input power	W_{i_a}	=	max.	110	kW
Anode dissipation	W_a	=	max.	30	kW
Negative grid voltage	$-V_g$	=	max.	1200	V
Grid current	I_g	=	max.	1.3	A

OPERATING CONDITIONS

Frequency	f	=	30	30	MHz
Anode voltage	V_a	=	10	10	kV
Grid voltage	V_g	=	-1050	-1050	V [1]
Grid driving voltage	V_{g_p}	=	1550	1450	V
Anode current	I_a	=	10.5	7.4	A
Grid current	I_g	=	1.1	0.8	A
Anode input power	W_{i_a}	=	105	74	kW
Anode dissipation	W_a	=	22	16	kW
Driving power	W_{dr}	=	1650	1100	W
Output power	W_o	=	83	58	kW
Efficiency	η	=	79	79	%
Modulation depth	m	=	100	100	%
Modulation power	W_{mod}	=	53	37	kW

---

1) Grid bias partly obtained by a grid resistor

R.F. CLASS C OSCILLATOR for industrial use with anode voltage from three-phase rectifier without filter

LIMITING VALUES (Absolute limits)

Frequency	f	up to	30	MHz
Anode voltage	V_a	= max.	13	kV
Anode current	I_a	= max.	15	A
Anode input power	W_{i_a}	= max.	180	kW
Anode dissipation	W_a	= max.	45	kW
Negative grid voltage	$-V_g$	= max.	1600	V
Grid current, loaded	I_g	= max.	1.0	A
Grid current, unloaded	I_g	= max.	1.4	A
Grid circuit resistance	R_g	= max.	10	kΩ

OPERATING CONDITIONS

Frequency	f	=	30	30	30	MHz
Anode voltage	V_a	=	12	12	10	kV
Anode current	I_a	=	14	12	10	A
Grid current	I_g	=	0.9	0.75	0.75	A
Grid circuit resistance	R_g	=	1100	1350	1100	Ω
Feedback ratio	$V_{g\sim}/V_{a\sim}$	=	15	14	14	%
Anode input power	W_{i_a}	=	168	144	100	kW
Anode dissipation	W_a	=	44	36	25	kW
Output power	W_o	=	124	108	75	kW
Efficiency	η	=	74	75	75	%
Output power in the load	W_ℓ	=	104	91	63	kW[1]

---

[1] Useful power in the load measured in a circuit having an efficiency of 85%

A.F. CLASS B AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute limits)

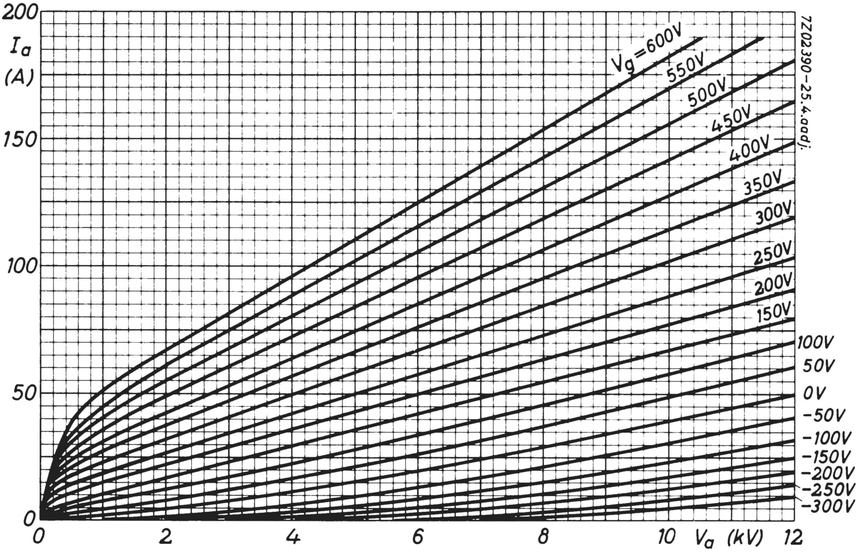
Anode voltage	V_a	=	max.	15	kV
Anode current	I_a	=	max.	12	A
Anode input power	W_{i_a}	=	max.	162	kW
Anode dissipation	W_a	=	max.	45	kW
Negative grid voltage	$-V_g$	=	max.	1200	V
Grid current	I_g	=	max.	1.2	A

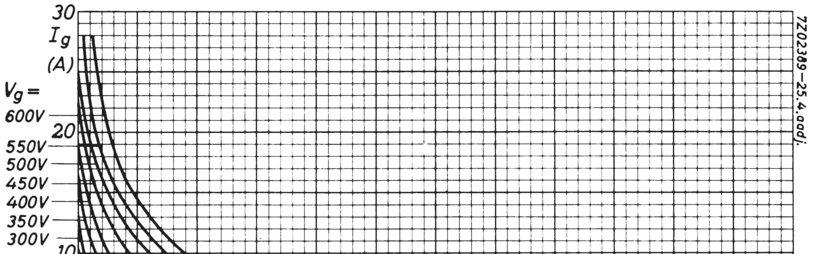
OPERATING CONDITIONS , two tubes in push-pull

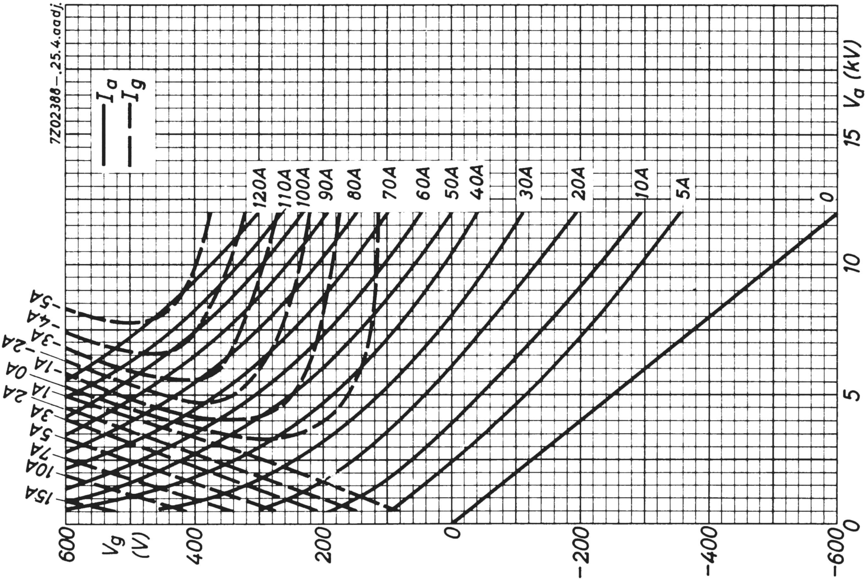
Anode voltage	V_a	=	10		10		kV
Grid voltage	V_g	=	-540		-540		V 1)
Load resistance	$R_{aa\sim}$	=	1360		1440		Ω
Driving voltage	V_{gg_p}	=	0	1550	0	1300	V
Anode current	I_a	=	2x0.3	2x8	2x0.3	2x5.8	A
Grid current	I_g	=	0	2x0.2	0	2x0.15	A
Anode input power	W_{i_a}	=	2x3	2x80	2x3	2x58	kW
Anode dissipation	W_a	=	2x3	2x27	2x3	2x26	kW
Driving power	W_{dr}	=	0	2x150	0	2x100	W
Output power	W_o	=	0	106	0	64	kW
Efficiency	η	=	–	67	–	56	%

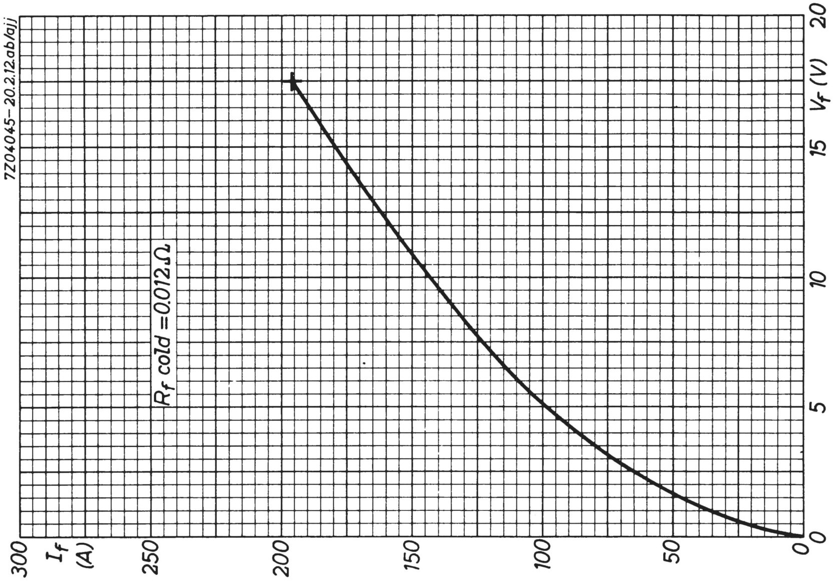
---

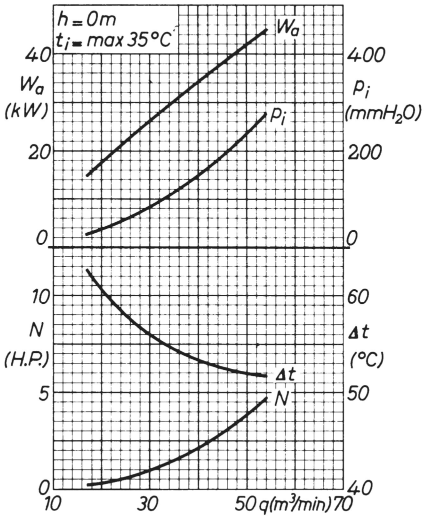
1) To be adjusted for a zero signal anode current of 0.3 A

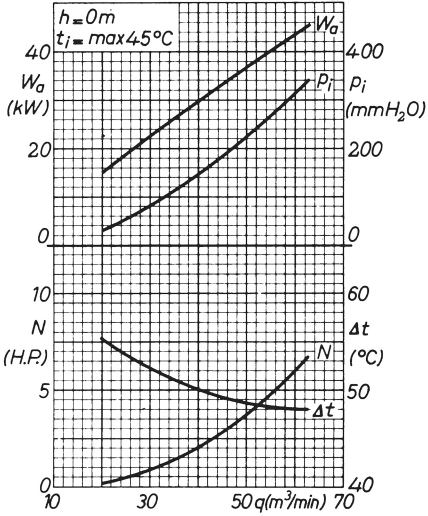

200
I_a
(A)
150
100
50
0
0
2
4
6
8
10
V_a (kV)
12
V_g=600V
550V
500V
450V
400V
350V
300V
250V
200V
150V
100V
50V
0V
-50V
-100V
-150V
-200V
-250V
-300V
7Z02390-25.4.aad.


30
I_g
(A)
V_g =
600V
550V
500V
450V
400V
350V
300V
250V
200V
150V
100V
50V
20
10
0
-10
0
2
4
6
8
10
V_a (kV)
12
V_g =
50V
100V
150V
200V
250V
300V
350V
400V
450V
500V
550V
600V
7Z02389-25.4.aad.

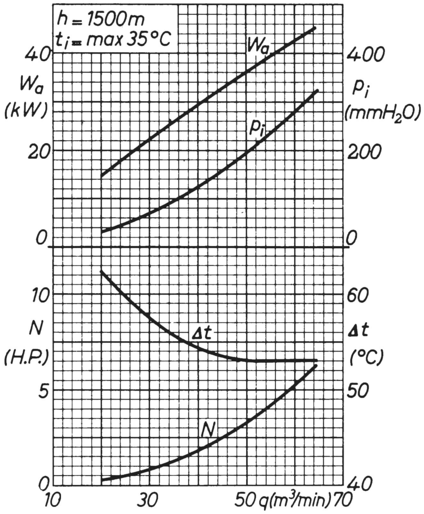

7Z02388-.25.4.aadj.
Ia
Ig
120A
110A
100A
90A
80A
70A
60A
50A
40A
30A
20A
10A
5A
0
Va (kV)
15
10
5
0
Vg (V)
600
400
200
0
-200
-400
-600
-5A
-4A
-3A
-2A
-1A
0A
1A
2A
3A
5A
7A
10A
15A

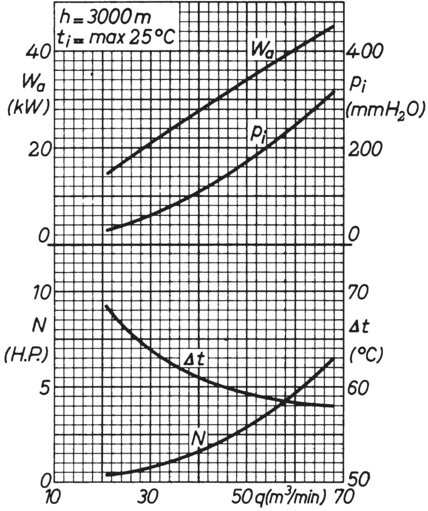

7Z04045-20.2.12ab/ajj
Rf cold = 0.012Ω
Vf (V)
20
15
10
5
0
If (A)
300
250
200
150
100
50
0





7Z06507 – 20.2.12.ab/ajj.





7Z06506 – 20.2.12.ab/ajj.

AIR COOLED R.F. INDUSTRIAL POWER TRIODE

Forced air cooled triode of ceramic-metal construction, intended for use as industrial oscillator.

QUICK REFERENCE DATA

Frequency	f	27.12	27.12	160	MHz
Anode voltage	V_a	5.0	6.0	5.0	kV
Anode current	I_a	1.0	1.0	1.0	A
Oscillator output power	W_{osc}	3.85	4.75	3.75	kW

HEATING: direct; filament thoriated tungsten

Filament voltage (< 120 MHz)	V_f	6.3	V	+5% -10%
(> 120 MHz)	V_f	6.0	V	+5% -10%
Filament current at V_f = 6.3 V	I_f	33	A	

CAPACITANCES

Anode to filament	C_{af}	0.4	pF
Grid to filament	C_{gf}	17	pF
Anode to grid	C_{ag}	14	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	2.0	kV
Anode current	I_a	0.5	A
Transconductance	S	10	mA/V
Amplification factor	μ	20	

TEMPERATURE LIMITS (Absolute max.)

Absolute max. envelope temperature	$t_{env.}$	max. 240	°C
Recommended max. envelope temperature under continuously loaded conditions	$t_{env.}$	max. 200	°C

AIR COOLING CHARACTERISTICS (see also cooling curves)

$W_a + W_g$ (kW)	h (m)	t_i (°C)	q_{min} (m^3/min)	p_i (mm H_2O)
1	0	35	1.25	3.2
1	0	45	1.9	5.0
3	0	35	5.7	17
3	0	45	6.1	18.4

ACCESSORIES

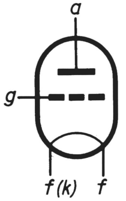
Filament connector	40688	
Filament/cathode connector	40689	
Grid connector (f < 30 MHz)	40686	
(f > 30 MHz)	40687	
Insulating pedestal	40630	net weight 2.1 kg

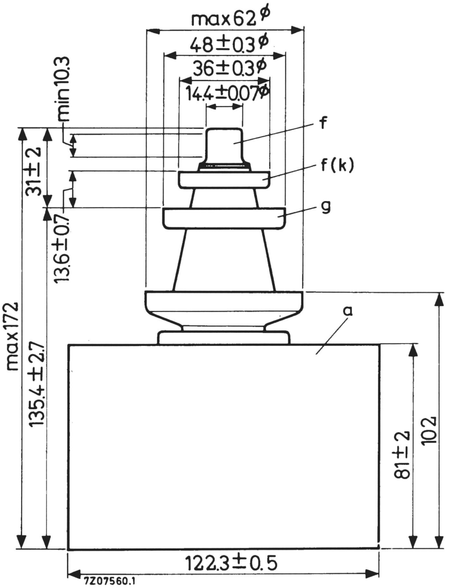
MECHANICAL DATA

Dimensions in mm

Mounting position: vertical with anode up or down

Net weight: 3.0 kg





max 62 ϕ
48 ± 0.3 ϕ
36 ± 0.3 ϕ
14.4 ± 0.07 ϕ
min 10.3
f
f(k)
g
a
31 ± 2
13.6 ± 0.7
max 172
135.4 ± 2.7
81 ± 2
102
122.3 ± 0.5
7Z07560.1

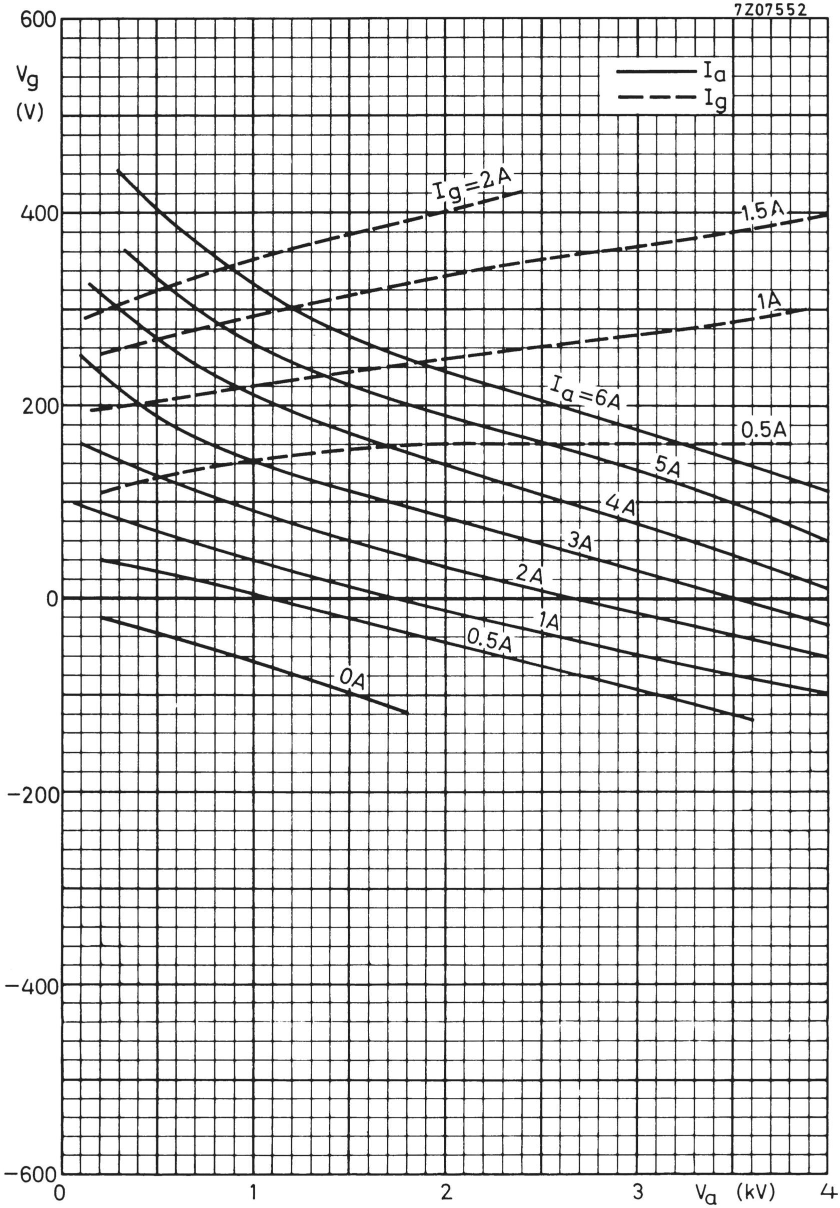
R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

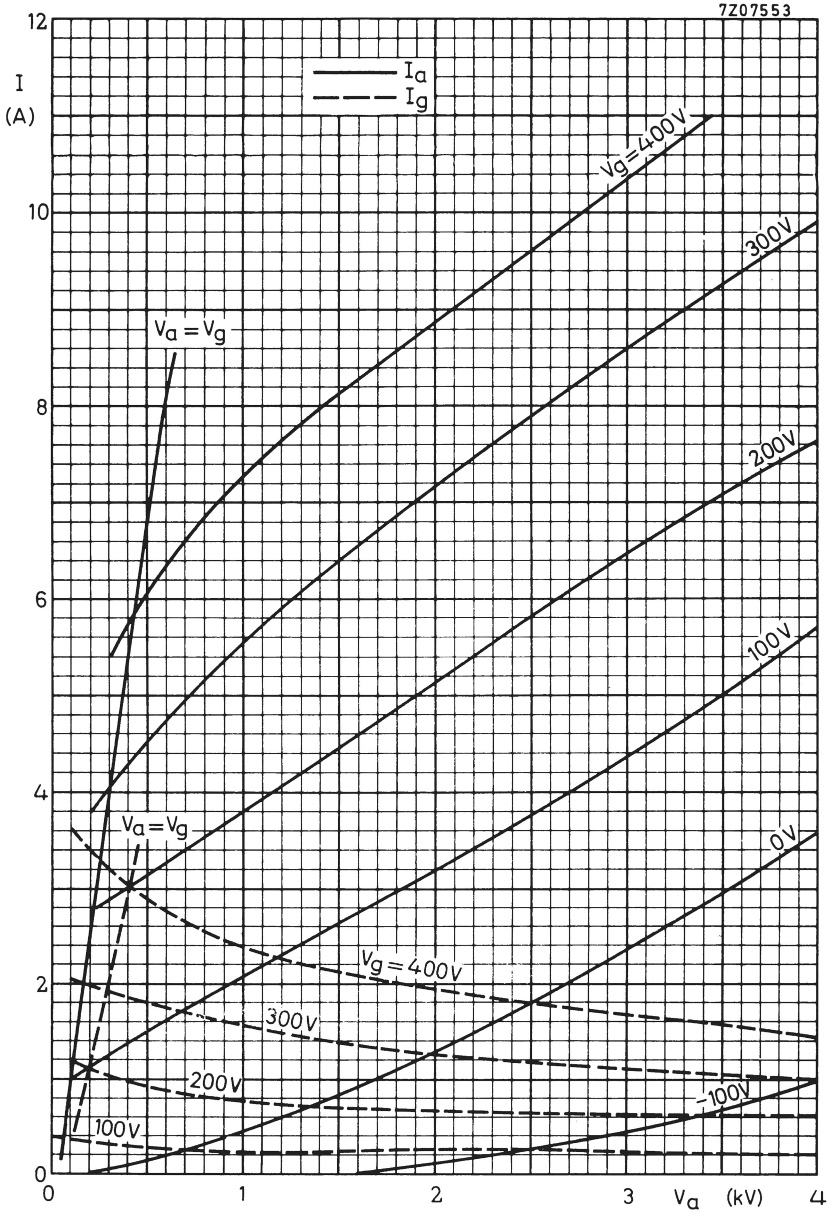
LIMITING VALUES (Absolute max. rating system)

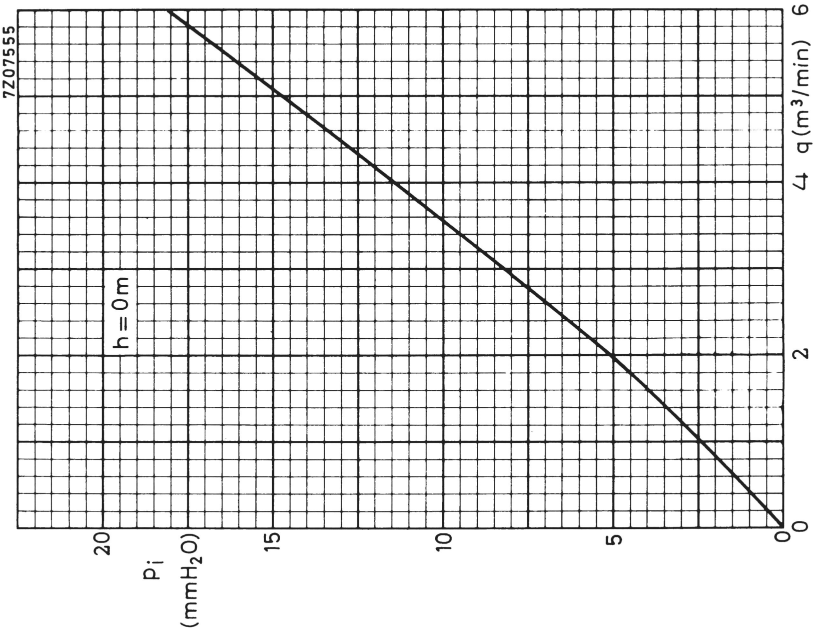
Frequency	f	up to	85	160	MHz
Anode voltage	V_a	max.	7.2	6.0	kV
Anode current	I_a	max.	1.1	1.1	A
Anode input power	W_{i_a}	max.	6.5	6.0	kW
Anode dissipation	W_a	max.	2.5	2.5	kW
Grid voltage	$-V_g$	max.	1.0	1.0	kV
Grid current, loaded	I_g	max.	280	280	mA
unloaded	I_g	max.	400	400	mA
Grid dissipation	W_g	max.	150	150	W
Grid circuit resistance	R_g	max.	20	20	kΩ
Cathode current	I_k	max.	1.4	1.4	A

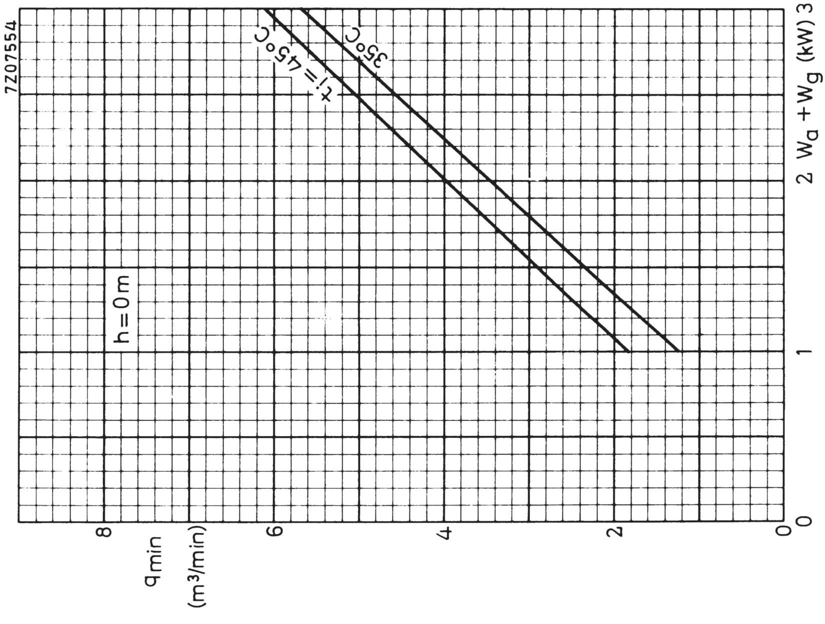
OPERATING CONDITIONS

Frequency	f	160	27.12	27.12	MHz
Filament voltage	V_f	6.0	6.3	6.3	V
Anode voltage	V_a	5.0	6.0	5.0	kV
Anode current	I_a	1.0	1.0	1.0	A
Anode input power	W_{i_a}	5.0	6.0	5.0	kW
Anode dissipation	W_a	1.03	1.0	0.93	kW
Anode output power	W_o	3.97	5.0	4.07	kW
Anode efficiency	η	79.4	83.3	81.4	%
Grid resistor	R_g	2.0	2.5	2.0	kΩ
Grid current, loaded	I_g	260	250	260	mA
Grid dissipation	W_g	80	90	80	W
Grid resistor dissipation	W_{R_g}	135	156	135	W
Oscillator output power	W_{osc}	3.75	4.75	3.85	kW
Oscillator efficiency	η_{osc}	75.0	79.1	77.0	%
Feedback ratio	$V_{g\sim}/V_{a\sim}$	17	17	17	%


7Z07552
600
400
200
0
−200
−400
−600
Vg
(V)
Ia
Ig
Ig=2A
1.5A
1A
0.5A
Ia=6A
5A
4A
3A
2A
1A
0.5A
0A
0
1
2
3
4
Va (kV)


7Z07553
I
(A)
12
10
8
6
4
2
0
Ia
Ig
Vg = 400V
300V
200V
100V
0V
−100V
Va = Vg
Va = Vg
Vg = 400V
300V
200V
100V
0
1
2
3
Va (kV)
4


7Z07555
h = 0 m
p_i
(mmH$_2$O)
20
15
10
5
0
0
2
4
6
q (m^3/min)


7Z07554
h = 0 m
t_i = 45 °C
35 °C
q_{min}
(m^3/min)
8
6
4
2
0
0
1
2
3
$W_a + W_g$ (kW)

WATER COOLED
R.F. INDUSTRIAL POWER TRIODE

Water cooled triode of ceramic-metal construction, intended for use as industrial oscillator. The tube is cooled by means of a separate jacket.

QUICK REFERENCE DATA					
Frequency	f	27.12	27.12	160	MHz
Anode voltage	V_a	5.0	6.0	5.0	kV
Anode current	I_a	1.0	1.0	1.0	A
Oscillator output power	W_{osc}	3.85	4.75	3.75	kW

COOLING CHARACTERISTICS See also cooling curves

Anode	Water cooled using jacket K713
Seals	Low velocity air flow may be required at frequencies above 4 MHz.

$W_a + W_g$ (kW)	t_i (°C)	q_{min} (ℓ/min)	p_i (atm)
1	20	2.5	0.11
1	50	3.0	0.12
3	20	3.0	0.14
3	50	6.8	0.38

ACCESSORIES

Filament connector	40688
Filament/cathode connector	40689
Grid connector (f < 30 MHz)	40686
Grid connector (f > 30 MHz)	40687
Water jacket	K713
O-ring	3322 026 82801

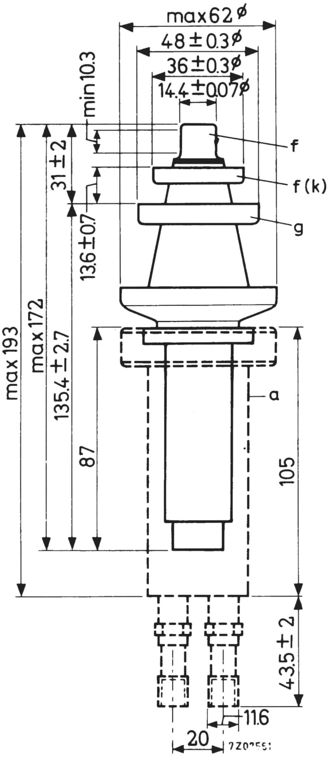
For further data and curves please refer to YD1150

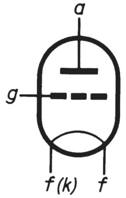
MECHANICAL DATA

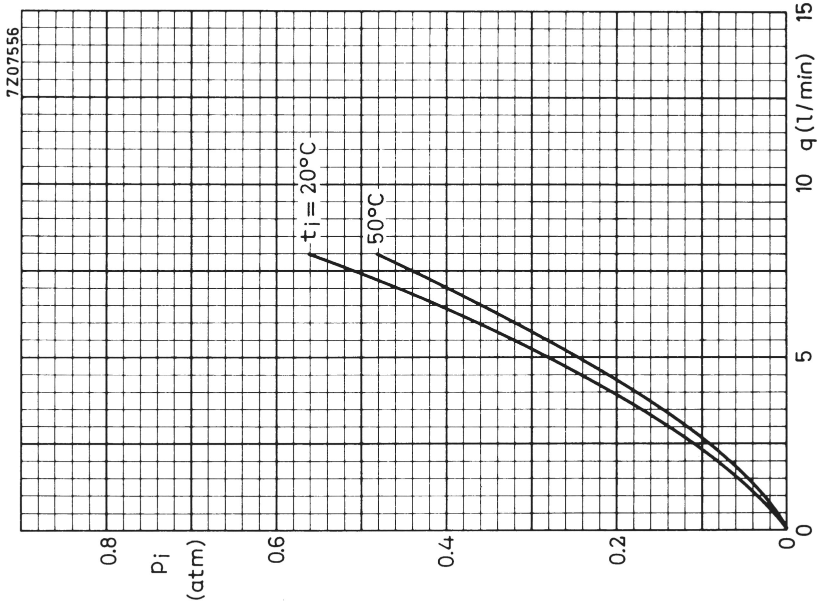
Dimensions in mm

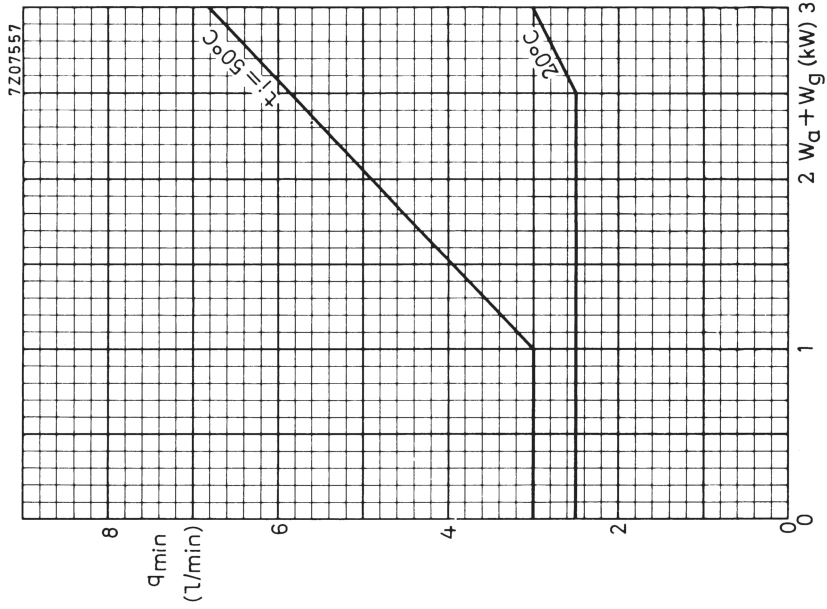
Mounting position: vertical anode down

Net weight: 0.65 kg


max 62 ø
48 ± 0.3 ø
36 ± 0.3 ø
14.4 ± 0.07 ø
min 10.3
31 ± 2
13.6 ± 0.7
max 193
max 172
135.4 ± 2.7
87
105
43.5 ± 2
11.6
20
f
f (k)
g
a




7Z07556
p_i
(atm)
0.8
0.6
0.4
0.2
0
$t_i = 20°C$
50°C
0
5
10
q (l/min)
15


7Z07557
q_{min}
(l/min)
8
6
4
2
0
$t_i = 50°C$
20°C
0
1
2
$W_a + W_g$ (kW)
3

WATER COOLED INDUSTRIAL R.F. POWER TRIODE WITH INTEGRAL HELICAL COOLER

Water cooled triode of ceramic-metal construction, intended for use as industrial oscillator. The tube has an integral helical cooler.

QUICK REFERENCE DATA

Frequency	f	27.12	27.12	160	MHz
Anode voltage	V_a	5.0	6.0	5.0	kV
Anode current	I_a	1.0	1.0	1.0	A
Oscillator output power	W_{osc}	3.85	4.75	3.75	kW

COOLING CHARACTERISTICS See also cooling curves

Anode Water cooled with integral helical cooler

Seals Low velocity air flow may be required at frequencies above 4 MHz

$W_a + W_g$ (kW)	t_i (°C)	q_{min} (ℓ/min)	p_i (atm)
1	20	0.9	0.05
1	50	1.4	0.06
3	20	2.2	0.14
3	50	4.1	0.27

ACCESSORIES

Filament connector	40688
Filament/cathode connector	40689
Grid connector (f < 30 MHz)	40686
Grid connector (f > 30 MHz)	40687

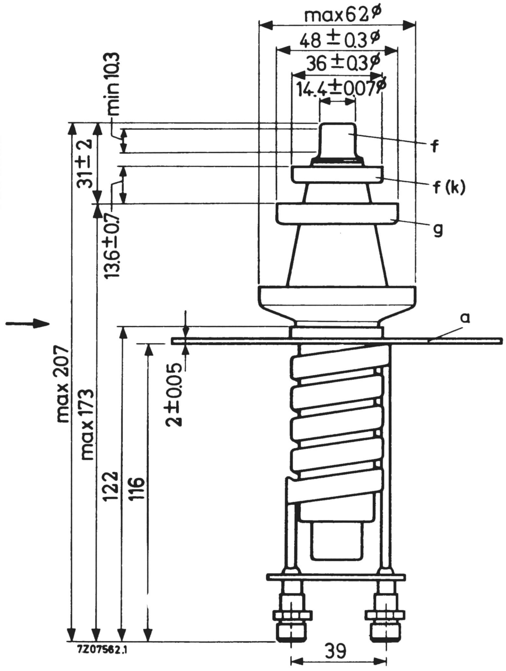
For further data and curves please refer to YD1150

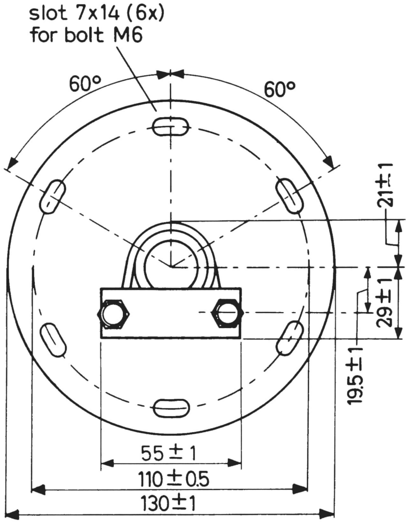
MECHANICAL DATA

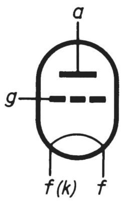
Dimensions in mm

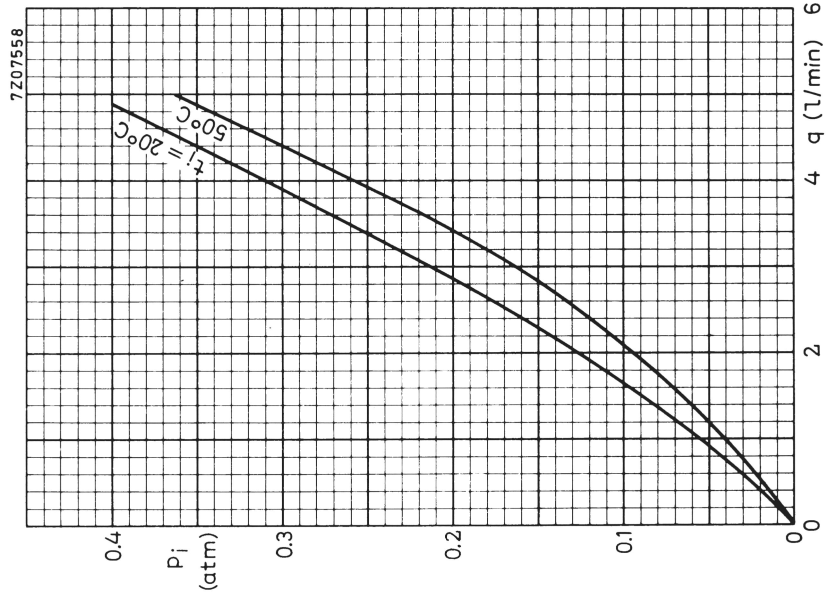
Mounting position: vertical anode down

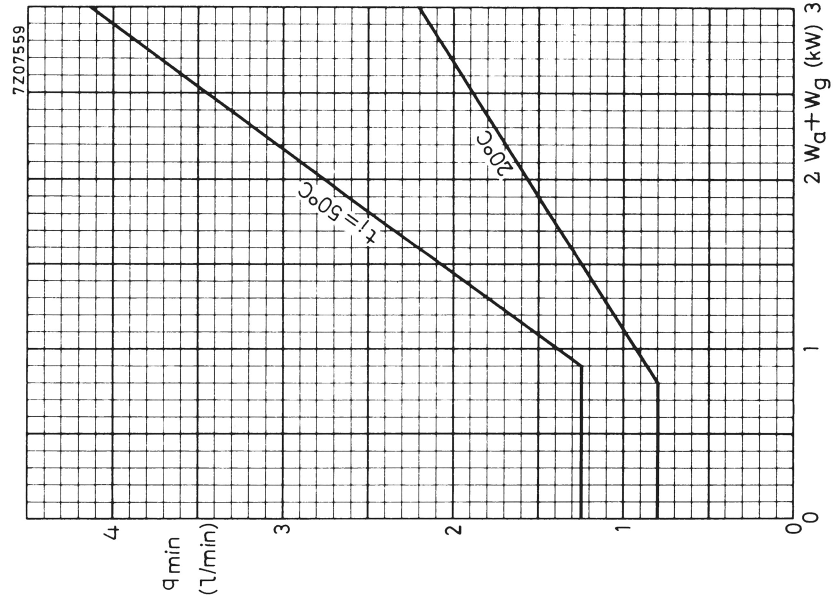
Net weight: 0.85 kg


max62ø
48 ±0.3ø
36 ±0.3ø
14.4±0.07ø
min 10.3
31±2
13.6±0.7
max 207
max 173
122
116
2±0.05
f
f (k)
g
a
39
7Z07562.1


slot 7x14 (6x)
for bolt M6
60°
60°
21±1
29±1
19.5±1
55±1
110±0.5
130±1




7Z07558
q (l/min)
0
2
4
6
p_i (atm)
0
0.1
0.2
0.3
0.4
t_i = 20°C
50°C


7Z07559
W_a+W_g (kW)
0
1
2
3
q_{min} (l/min)
0
1
2
3
4
t_i = 50°C
20°C

AIR COOLED R.F. INDUSTRIAL POWER TRIODE

Forced air cooled triode of ceramic-metal construction, intended for use as industrial oscillator.

QUICK REFERENCE DATA

Frequency	f	27.12	27.12	150	MHz
Anode voltage	V_a	6.5	6.0	5.0	kV
Anode current	I_a	1.8	1.6	2.0	A
Oscillator output power	W_{osc}	8.8	7.5	7.15	kW

HEATING: direct; filament thoriated tungsten

Filament voltage (f = 150 MHz)	V_f	5.8	V	$^{+5\%}_{-10\%}$
(f < 150 MHz)	V_f	6.3	V	$^{+5\%}_{-10\%}$
Filament current at V_f = 6.3 V	I_f	66	A	

CAPACITANCES

Anode to filament	C_{af}	0.5	pF
Grid to filament	C_{gf}	16	pF
Anode to grid	C_{ag}	19	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	2	kV
Anode current	I_a	1	A
Transconductance	S	22	mA/V
Amplification factor	μ	20	-

TEMPERATURE LIMITS (Absolute max.)

Absolute max. envelope temperature	t_{env}	max. 240	°C
Recommended max. envelope temperature under continuously loaded conditions	t_{env}	max. 200	°C

AIR COOLING CHARACTERISTICS (See also cooling curves)

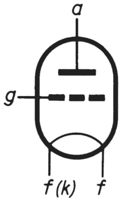
$W_a + W_g$ (kW)	h (m)	t_i (^oC)	q_{min} (m^3/min)	p_i ($mm\,H_2O$)
3	0	35	3.6	9
3	0	45	4.2	11

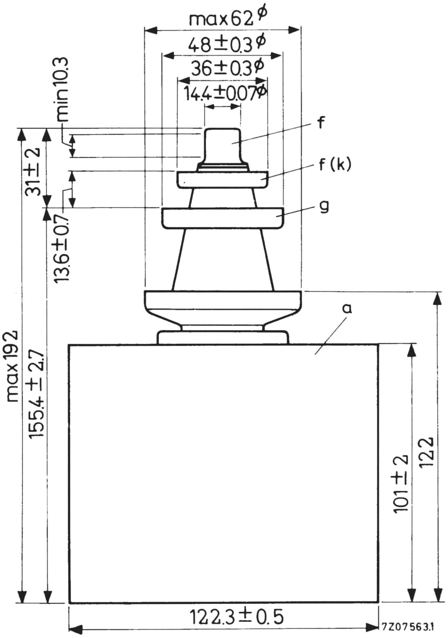
MECHANICAL DATA

Dimensions in mm

Mounting position: vertical, with anode up or down

Net weight: 3.9 kg




max62ϕ
48±0.3ϕ
36±0.3ϕ
14.4±0.07ϕ
min10.3
f
f(k)
g
31±2
13.6±0.7
a
max192
155.4±2.7
101±2
122
122.3±0.5
7Z07563.1

ACCESSORIES

Filament connector	40688
Filament/cathode connector (f < 30 MHz)	40689
Grid connector (f < 30 MHz)	40686
Grid connector (f > 30 MHz)	40687
Insulating pedestal	40630 net weight 2.1 kg

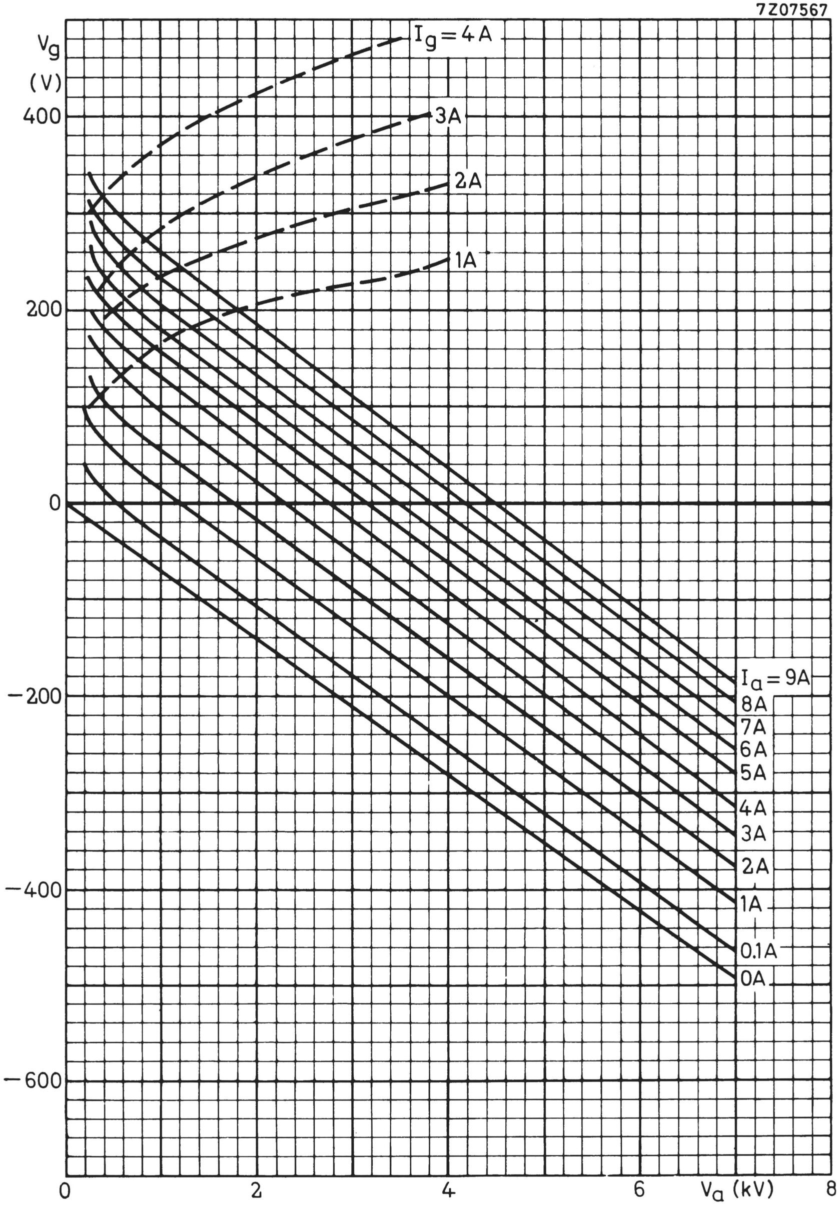
R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

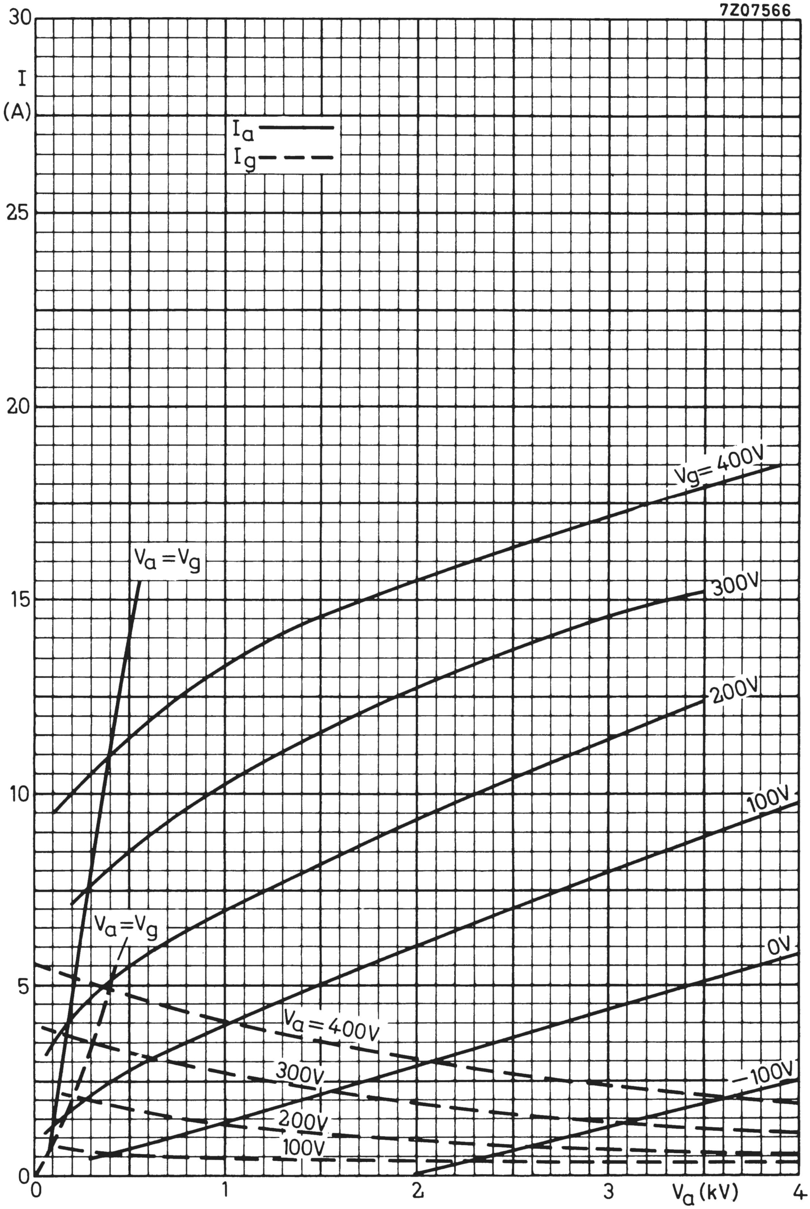
LIMITING VALUES (Absolute max. rating system)

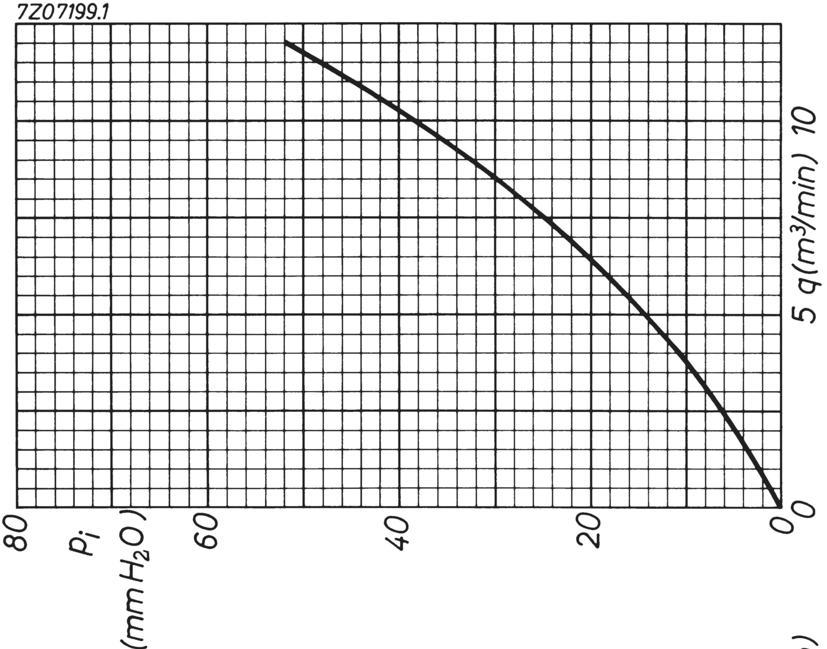
Frequency	f	up to	85	150	MHz
Anode voltage	V_a	max.	7.2	6.0	kV
Anode current	I_a	max.	2.2	2.2	A
Anode input power	W_{i_a}	max.	12.5	11.0	kW
Anode dissipation	W_a	max.	5.0	5.0	kW
Grid voltage	$-V_g$	max.	1.0	1.0	kV
Grid current, loaded	I_g	max.	550	550	mA
unloaded	I_g	max.	750	750	mA
Grid dissipation	W_g	max.	250	250	W
Grid circuit resistance	R_g	max.	20	20	kΩ
Cathode current	I_k	max.	2.8	2.8	A

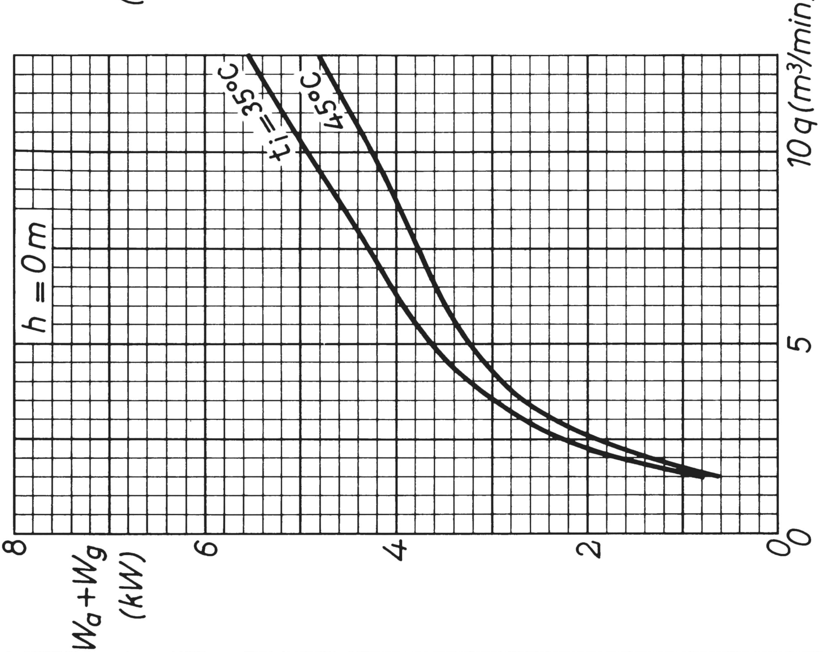
OPERATING CONDITIONS

Frequency	f	150	27.12	27.12	MHz
Filament voltage	V_f	5.8	6.3	6.3	V
Anode voltage	V_a	5.0	6.5	6.0	kV
Anode current	I_a	2.0	1.8	1.6	A
Anode input power	W_{ia}	10.0	11.7	9.6	kW
Anode dissipation	W_a	2.45	2.5	1.7	kW
Anode output power	W_o	7.55	9.2	7.9	kW
Anode efficiency	η	75.5	78.6	82.3	%
Grid resistor	R_g	1.0	1.6	1.3	kΩ
Grid current, loaded	I_g	480	430	480	mA
Grid dissipation	W_g	100	110	120	W
Grid resistor dissipation	W_{R_g}	230	296	300	W
Oscillator output power	W_{osc}	7.15	8.8	7.5	kW
Oscillator efficiency	η_{osc}	71.5	75.2	78.1	%
Feedback ratio	$V_{g\sim}/V_{a\sim}$	15	16	15	%


7Z07567
Vg (V)
400
200
0
−200
−400
−600
Ig = 4 A
3A
2A
1A
Ia = 9A
8A
7A
6A
5A
4A
3A
2A
1A
0.1A
0A
0
2
4
6
Va (kV)
8


7Z07566
30
I
(A)
25
20
15
10
5
0
Ia
Ig
Va =Vg
Vg= 400V
300V
200V
100V
0V
−100V
Va =Vg
Va = 400V
300V
200V
100V
0
1
2
3
Va (kV)
4


7Z07199.1
80
P_i
(mmH_2O)
60
40
20
0
0
5
q (m^3/min)
10


h = 0 m
t_i = 35°C
45°C
10 q (m^3/min)
5
0
0
2
4
6
8
W_a+W_g
(kW)

WATER COOLED R.F. INDUSTRIAL POWER TRIODE

Water cooled triode of ceramic-metal construction, intended for use as industrial oscillator. The tube is cooled by means of a separate jacket.

QUICK REFERENCE DATA					
Frequency	f	27.12	27.12	150	MHz
Anode voltage	V_a	6.5	6.0	5.0	kV
Anode current	I_a	1.8	1.6	2.0	A
Oscillator output power	W_{osc}	8.8	7.5	7.15	kW

COOLING CHARACTERISTICS (See also cooling curves)

Anode	Water cooled using jacket K 726
Seals	Low velocity air flow may be required

W_a+W_g (kW)	t_i (^oC)	q_{min} (ℓ/min)	p_i (atm)
3	20	3	0.16
3	50	7	0.52
5	20	5	0.34
5	50	11.5	1.4

ACCESSORIES

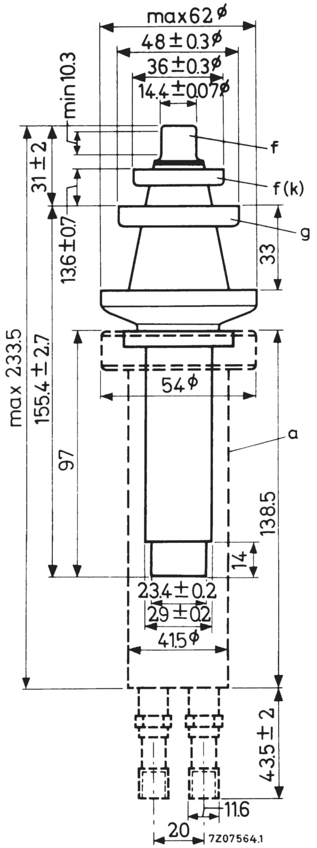
Filament connector	40688
Filament/cathode connector (f < 30 MHz)	40689
Grid connector (f < 30 MHz)	40686
Grid connector (f > 30 MHz)	40687
Water jacket	K726 net weight 0.73 kg
O-ring	3322 026 82801

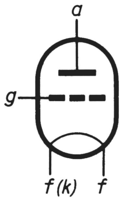
For further data and curves please refer to YD1160

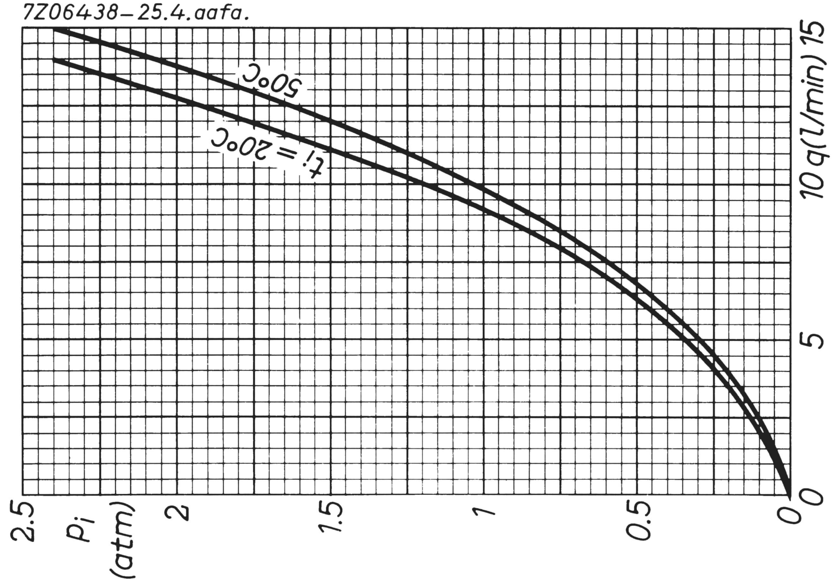
MECHANICAL DATA Dimensions in mm

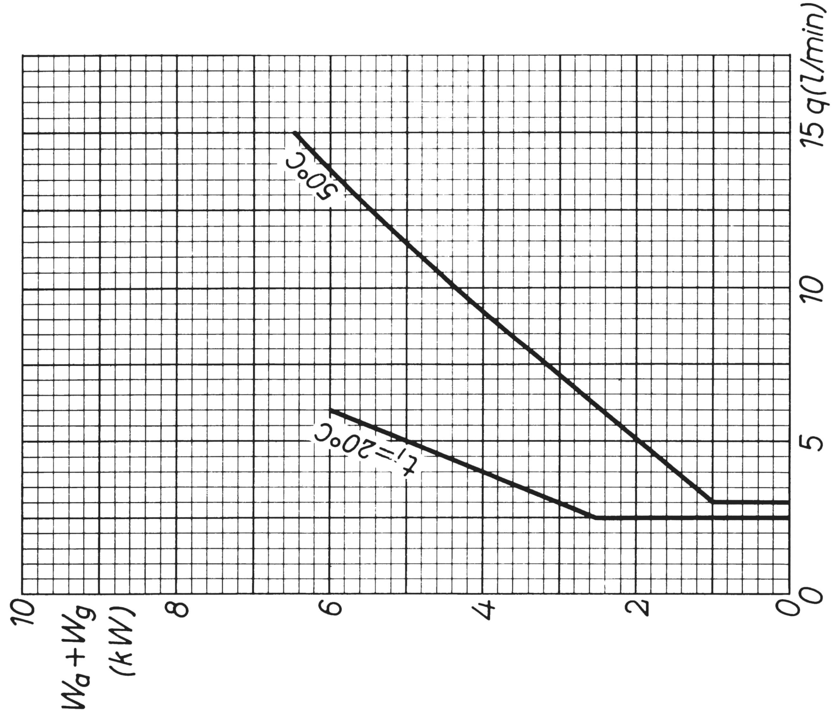
Mounting position: vertical, anode down

Net weight: 0.66 kg


max62ø
48±0.3ø
36±0.3ø
14.4±0.07ø
min10.3
31±2
f
f(k)
g
13.6±0.7
33
max 233.5
155.4±2.7
97
54ø
a
138.5
14
23.4±0.2
29±0.2
41.5ø
43.5±2
11.6
20
7Z07564.1




7Z06438-25.4.aafa.
p_i (atm)
2.5
2
1.5
1
0.5
0
0
5
10
15
q (l/min)
t_i = 20 °C
50 °C


W_a+W_g (kW)
10
8
6
4
2
0
0
5
10
15
q (l/min)
t_i=20 °C
50 °C

WATER COOLED INDUSTRIAL R.F. POWER TRIODE WITH INTEGRAL HELICAL COOLER

Water cooled triode of ceramic-metal construction, intended for use as industrial oscillator. The tube has an integral helical cooler.

QUICK REFERENCE DATA

Frequency	f	27.12	27.12	150	MHz
Anode voltage	V_a	6.5	6.0	5.0	kV
Anode current	I_a	1.8	1.6	2.0	A
Oscillator output power	W_{osc}	8.8	7.5	7.15	kW

COOLING CHARACTERISTICS (See also cooling curves)

Anode	Water cooled with integral helical cooler
Seals	Low velocity air flow may be required

W_a+W_g (kW)	t_i (°C)	q_{min} (ℓ/min)	p_i (atm)
3	20	2.2	0.18
3	50	4.3	0.38
5	20	4.0	0.40
5	50	8.0	1.4

ACCESSORIES

Filament connector	40688
Filament/cathode connector ($f < 30$ MHz)	40689
Grid connector ($f < 30$ MHz)	40686
Grid connector ($f > 30$ MHz)	40687

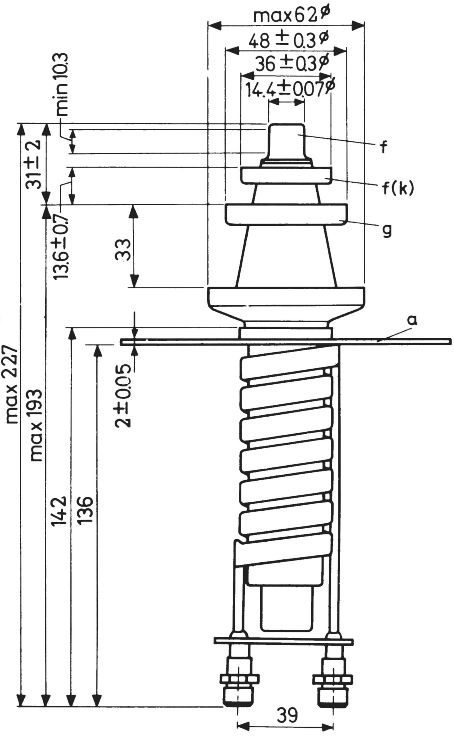
For further data and curves please refer to YD1160

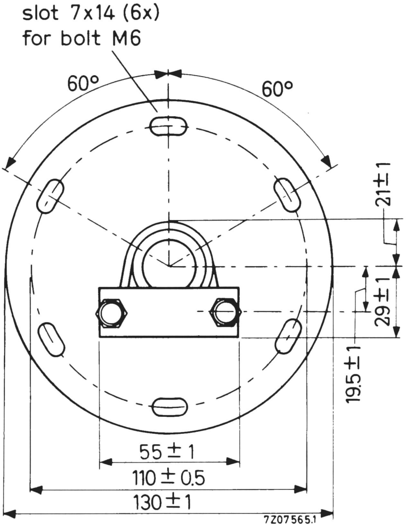
MECHANICAL DATA

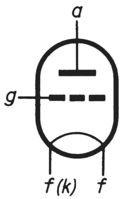
Dimensions in mm

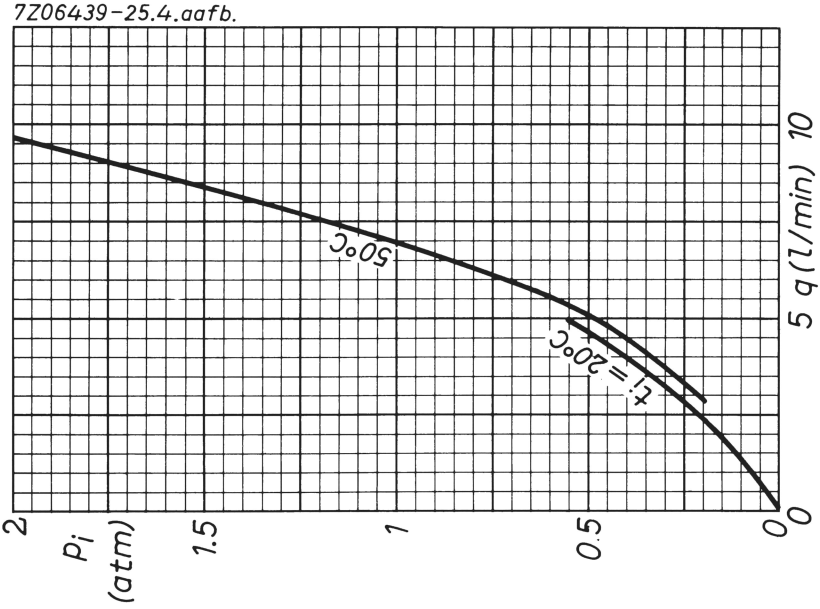
Mounting position: vertical, anode up or down

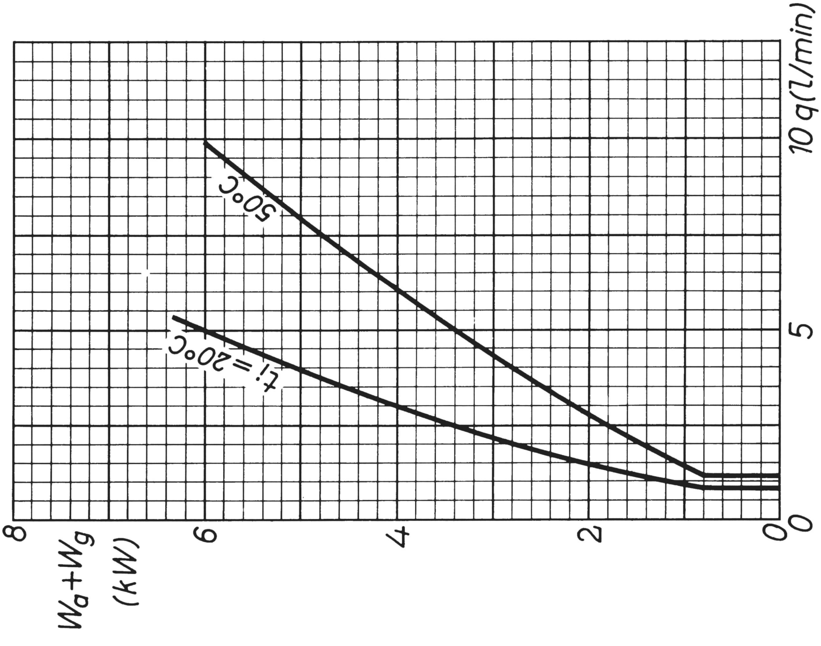
Net weight: 1.03 kg


max62⌀
48 ± 0.3⌀
36 ± 0.3⌀
14.4 ± 0.07⌀
min 10.3
31 ± 2
13.6 ± 0.7
33
2 ± 0.05
max 227
max 193
142
136
39
f
f(k)
g
a


slot 7x14 (6x)
for bolt M6
60°
60°
21 ± 1
29 ± 1
19.5 ± 1
55 ± 1
110 ± 0.5
130 ± 1
7Z07565.1




7Z06439-25.4.aafb.
p_i (atm)
2
1.5
1
0.5
0
q (l/min)
0
5
10
50 °C
t_i = 20 °C


W_a+W_g (kW)
8
6
4
2
0
q (l/min)
0
5
10
50 °C
t_i = 20 °C

AIR COOLED R.F. INDUSTRIAL POWER TRIODE

Forced air cooled triode of ceramic-metal construction, intended for use as industrial oscillator.

QUICK REFERENCE DATA			
Frequency	f	up to 120	MHz
Anode voltage	V_a	6	kV
Anode current	I_a	3.4	A
Oscillator output power	W_{osc}	15.4	kW

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	5.8	V $^{+5\%}_{-10\%}$
Filament current	I_f	130	A
Peak filament starting current	I_{f_p}	max. 800	A
Cold filament resistance	R_{f_o}	0.0056	Ω

To maintain a constant cathode temperature as a function of the operating frequency of the tube it may be necessary to decrease the filament voltage at higher frequencies. The quotient of the filament voltage and current should be the same as that when only the filament voltage is applied to the tube.

CAPACITANCES

Anode to filament	C_{af}	=	0.6	pF
Grid to filament	C_{gf}	=	47	pF
Anode to grid	C_{ag}	=	24	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	6000	V
Anode current	I_a	=	2	A
Mutual conductance	S	=	33	mA/V
Amplification factor	μ	=	29	

TEMPERATURE LIMITS

Absolute max. envelope temperature	t_{env}	max.	240	°C
Recommended max. envelope temperature under continuously loaded conditions	t_{env}	max.	200	°C
Absolute max. air inlet temperature	t_i	max.	45	°C

AIR COOLING CHARACTERISTICS (See also cooling curves)

$W_a + W_g$ (kW)	h m	t_i (°C)	q_{min} (m^3/min)	p_i (mm H_2O)	t_o (°C)
10	0	35	9.5	55	94
8	0	35	6.5	28	105
6	0	35	4.5	15	113
4	0	35	3.0	8	117
10	0	45	11.0	69	98
8	0	45	7.6	35	108
6	0	45	5.2	19	115
4	0	45	3.5	10	119
10	1500	35	11.4	63	94
8	1500	35	7.8	32	105
6	1500	35	5.5	17	113
4	1500	35	3.6	9	117
10	3000	25	12.0	62	90
8	3000	25	8.2	32	102
6	3000	25	5.7	17	111
4	3000	25	3.8	9	116

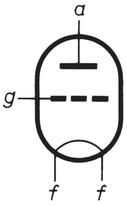
At the lower values of anode dissipation and at the highest operating frequencies additional cooling of the seals is required.

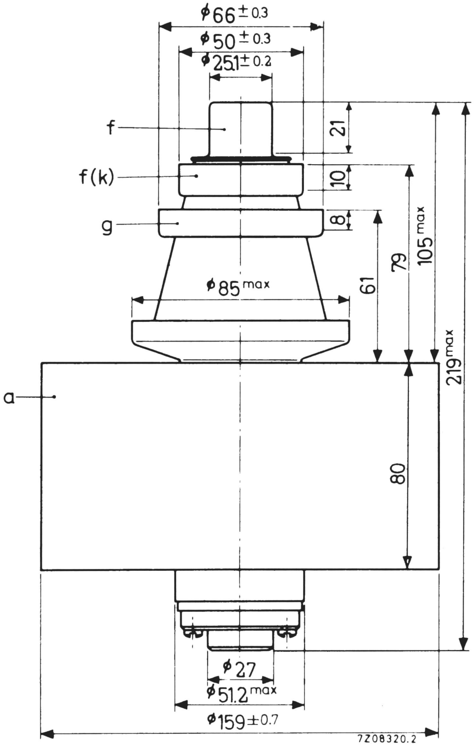
Direction of air flow: arbitrary

MECHANICAL DATA

Net weight approx. 7.5 kg

Dimensions in mm




ϕ66 ± 0.3
ϕ50 ± 0.3
ϕ25.1 ± 0.2
f
f(k)
g
21
10
8
61
79
105 max
219 max
ϕ85 max
a
80
ϕ27
ϕ51.2 max
ϕ159 ± 0.7
7Z08320.2

Mounting position: vertical with anode up or down

ACCESSORIES

Insulating pedestal		40654	net weight		4.25 kg
Grid connector	f ≦ 4 MHz	40690	"	"	55 g
	f > 4 MHz	40691	"	"	240 g
Filament connectors (both types required)		40692	"	"	140 g
and		40693	"	"	165 g
Filament cables (2x)		40715	"	"	200 g

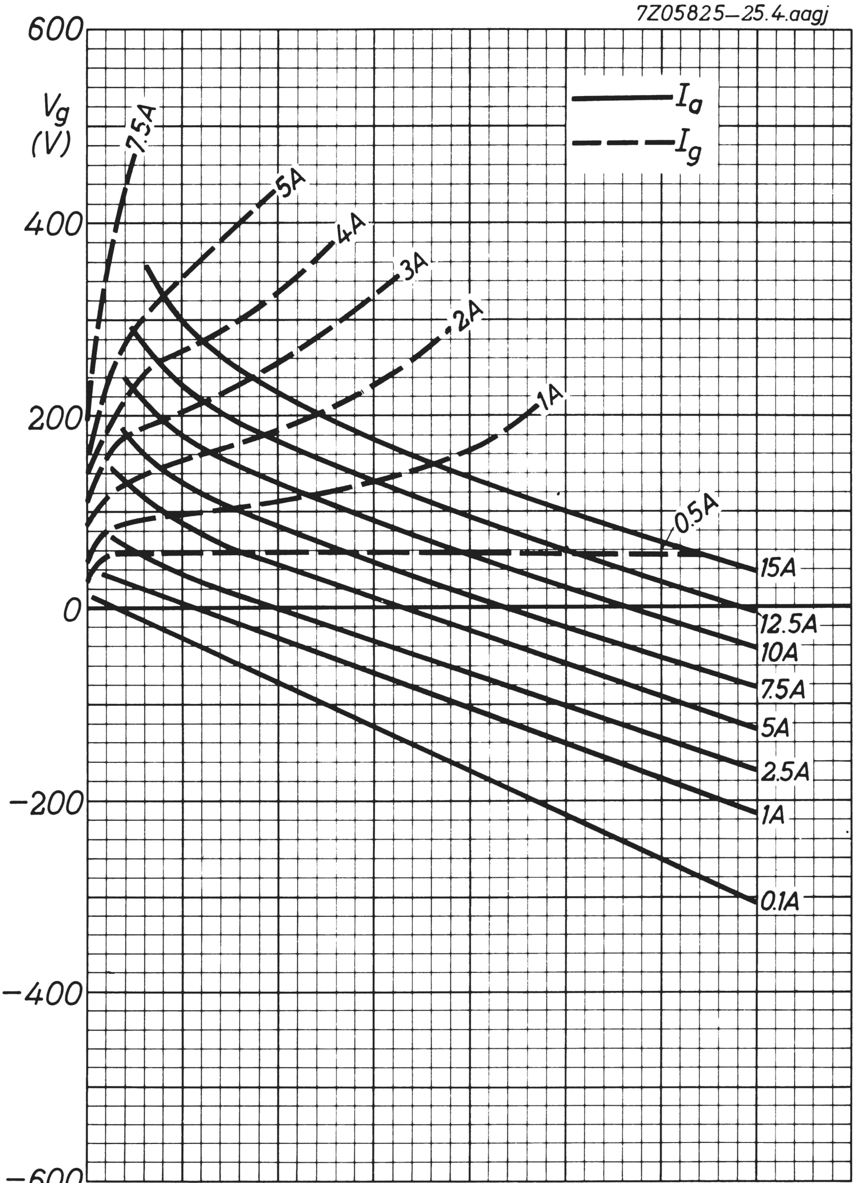
R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

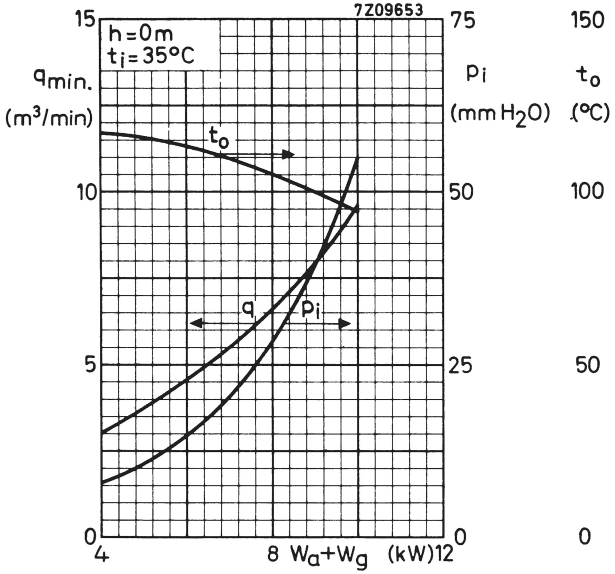
LIMITING VALUES (Absolute max. rating system)

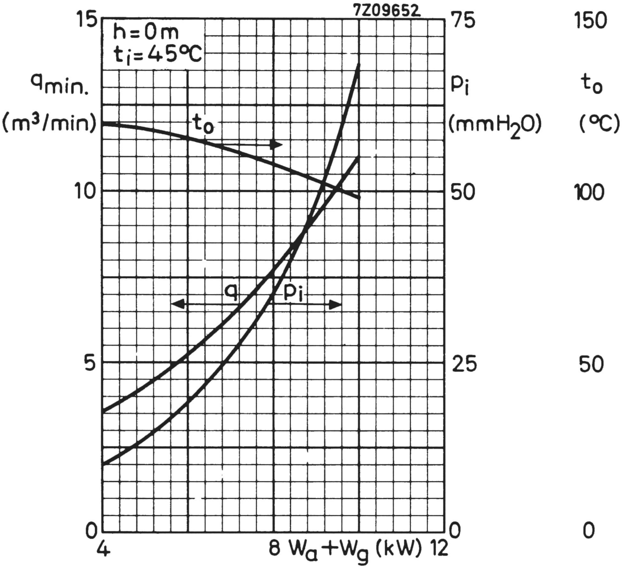
Frequency	f	up to	120	MHz
Anode voltage	V_a	max.	7.2	kV
Anode current	I_a	max.	4.0	A
Anode input power	W_{i_a}	max.	24	kW
Anode dissipation	W_a	max.	10	kW
Grid voltage	V_g	max.	1.5	kV
Grid current, loaded	I_g	max.	1.0	A
unloaded	I_g	max.	1.5	A
Grid dissipation	W_g	max.	350	W
Grid circuit resistance	R_g	max.	10	kΩ
Cathode current	I_k	max.	5.0	A

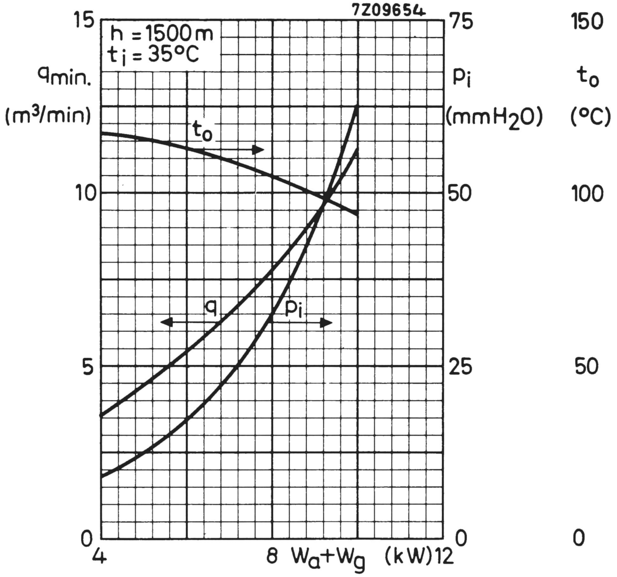
OPERATING CONDITIONS

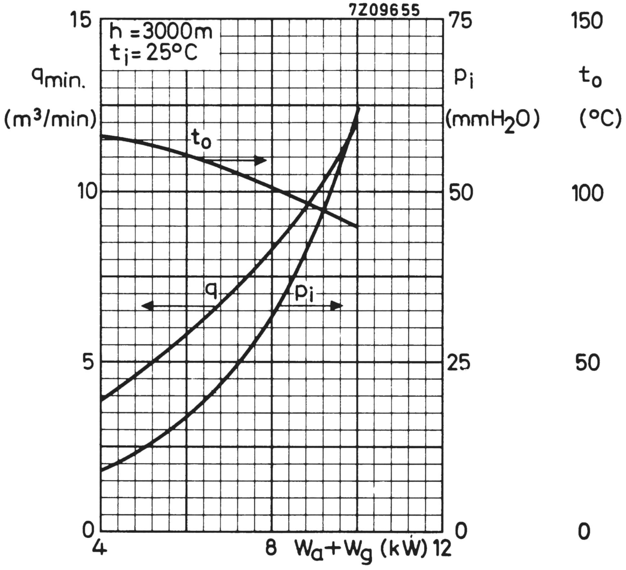
Frequency	f	120	MHz
Filament voltage	V_f	see under "HEATING"	V
Anode voltage	V_a	6.0	kV
Anode current	I_a	3.4	A
Anode input power	W_{i_a}	20.4	kW
Anode dissipation	W_a	4.3	kW
Anode output power	W_o	16.1	kW
Anode efficiency	η	78.9	%
Grid resistor	R_g	500	Ω
Grid current, loaded	I_g	920	mA
Grid dissipation	W_g	280	W
Grid resistor dissipation	W_{R_g}	423	W
Oscillator output power	W_{osc}	15.4	kW
Oscillator efficiency	N_{osc}	75.5	%
Feedback ratio	$V_{g\sim}/V_{a\sim}$	15.5	%


7Z05825—25.4.aagj
V_g (V)
600
400
200
0
−200
−400
−600
0
2
4
6
V_a (kV)
8
I_a
I_g
7.5A
5A
4A
3A
2A
1A
0.5A
15A
12.5A
10A
7.5A
5A
2.5A
1A
0.1A


7Z09653
h = 0 m
t_i = 35 °C
$q_{min.}$
(m³/min)
p_i
(mm H₂O)
t_o
(°C)
t_o
q
p_i
15
10
5
0
75
50
25
0
150
100
50
0
4
8 W_a+W_g (kW) 12


7Z09652
h = 0 m
t_i = 45 °C
$q_{min.}$
(m³/min)
p_i
(mmH₂O)
t_o
(°C)
t_o
q
p_i
15
10
5
0
75
50
25
0
150
100
50
0
4
8 W_a+W_g (kW) 12


7Z09654
h = 1500 m
t_i = 35°C
$q_{min.}$
(m³/min)
p_i
(mmH₂O)
t_o
(°C)
t_o
q
p_i
15
10
5
0
75
50
25
0
150
100
50
0
4
8
W_a+W_g (kW)
12


7Z09655
h = 3000 m
t_i = 25°C
$q_{min.}$
(m³/min)
p_i
(mmH₂O)
t_o
(°C)
t_o
q
p_i
15
10
5
0
75
50
25
0
150
100
50
0
4
8
W_a+W_g (kW)
12

WATER COOLED R.F. INDUSTRIAL POWER TRIODE

Water cooled triode of ceramic-metal construction, intended for use as industrial oscillator. The tube is cooled by means of a separate jacket.

QUICK REFERENCE DATA			
Frequency	f	up to 120	MHz
Anode voltage	V_a	6	kV
Anode current	I_a	3.4	A
Oscillator output power	W_{osc}	15.4	kW

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	5.8	V	$^{+5\%}_{-10\%}$
Filament current	I_f	130	A	
Peak filament starting current	I_{f_p}	max. 800	A	
Cold filament resistance	R_{f_o}	0.0056	Ω	

To maintain a constant cathode temperature as a function of the operating frequency of the tube, it may be necessary to decrease the filament voltage at higher frequencies. The quotient of the filament voltage and -current should be the same as that when only the filament voltage is applied.

CAPACITANCES

Anode to filament	C_{af}	0.6	pF
Grid to filament	C_{gf}	47	pF
Anode to grid	C_{ag}	24	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	6000	V
Anode current	I_a	2	A
Mutual conductance	S	33	mA/V
Amplification factor	μ	29	

TEMPERATURE LIMITS

Absolute max. envelope temperature	t_{env}	max.	240	°C
Recommended max. envelope temperature under continuously loaded conditions	t_{env}	max.	200	°C
Absolute max. water inlet temperature	t_i	max.	50	°C

WATER COOLING CHARACTERISTICS (See also cooling curves)

$W_a + W_g$ (kW)	t_i (°C)	q_{min} (ℓ/min)	p_i (atm)	t_o (°C)
10	20	10.0	0.60	36
8	20	7.8	0.38	37
6	20	5.7	0.22	38
10	50	15.0	1.25	61
8	50	11.3	0.75	62
6	50	8.2	0.42	62

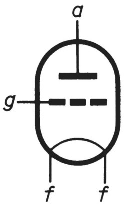
For water inlet temperatures between 20 °C and 50 °C the required quantity of water can be found by linear interpolation.

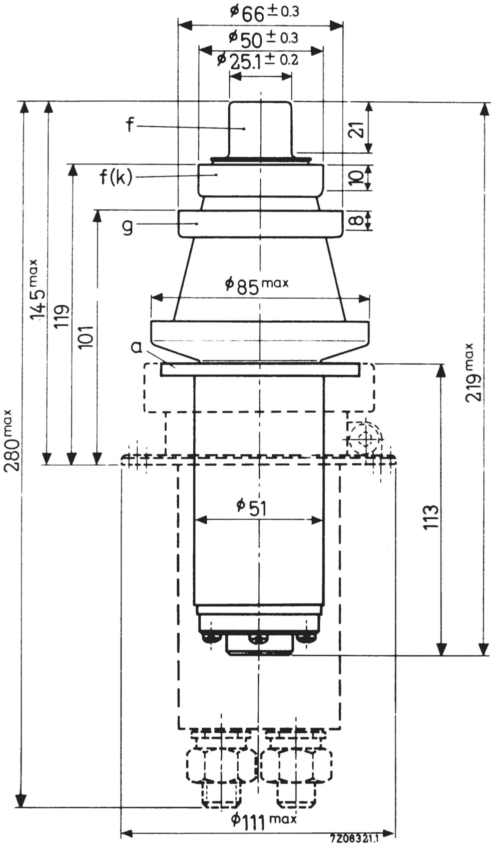
At frequencies higher than 4 MHz air cooling of the seals is required.

MECHANICAL DATA

Net weight: approx. 1.5 kg

Dimensions in mm



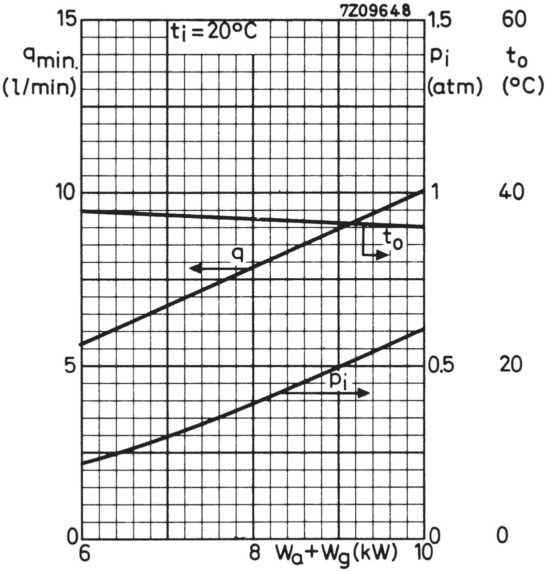

ϕ66 ±0.3
ϕ50 ±0.3
ϕ25.1 ±0.2
f
f(k)
g
a
21
10
8
ϕ85 max
145 max
119
101
280 max
219 max
113
ϕ51
ϕ111 max
7Z08321.1

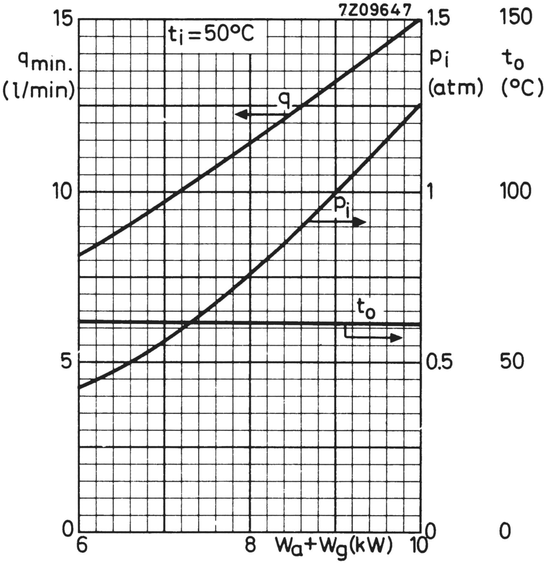
Mounting position: vertical with anode down

ACCESSORIES

Water jacket		K727	net weight		2	kg
Grid connector	f ≦ 4 MHz	40690	"	"	55	g
	f > 4 MHz	40691	"	"	240	g
Filament connectors (both types required)		40692	"	"	140	g
and		40693	"	"	165	g
Filament cables (2x)		40715	"	"	200	g
→ **O-ring**		**2622 080 31776**				

For further data and curves please refer to type YD1170


7Z09648
$t_i = 20°C$
15
$q_{min.}$ (l/min)
10
5
0
1.5
p_i (atm)
1
0.5
0
60
t_o (°C)
40
20
0
q
t_o
p_i
6
8
$W_a + W_g$ (kW)
10


7Z09647
$t_i = 50°C$
15
$q_{min.}$ (l/min)
10
5
0
1.5
p_i (atm)
1
0.5
0
150
t_o (°C)
100
50
0
q
p_i
t_o
6
8
$W_a + W_g$ (kW)
10

WATER COOLED INDUSTRIAL R.F. POWER TRIODE WITH INTEGRAL HELICAL COOLER

Water cooled triode of ceramic-metal construction, intended for use as industrial oscillator. The tube has an integral helical cooler.

QUICK REFERENCE DATA			
Frequency	f	up to 120	MHz
Anode voltage	V_a	6	kV
Anode current	I_a	3.4	A
Oscillator output power	W_{osc}	15.4	kW

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	5.8	V $^{+5\%}_{-10\%}$
Filament current	I_f	130	A
Peak filament starting current	I_{f_p}	max. 800	A
Cold filament resistance	R_{f_o}	0.0056	Ω

To maintain a constant cathode temperature as a function of the operating frequency of the tube, it may be necessary to decrease the filament voltage at higher frequencies. The quotient of the filament voltage and -current should be the same as that when only the filament voltage is applied.

CAPACITANCES

Anode to filament	C_{af}	0.6	pF
Grid to filament	C_{gf}	47	pF
Anode to grid	C_{ag}	24	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	6000	V
Anode current	I_a	2	A
Mutual conductance	S	33	mA/V
Amplification factor	μ	29	

TEMPERATURE LIMITS

Absolute max. envelope temperature	t_{env}	max.	240	°C
Recommended max. envelope temperature under continuously loaded conditions	t_{env}	max.	200	°C
Absolute max. water inlet temperature	t_i	max.	50	°C

WATER COOLING CHARACTERISTICS (See also cooling curves)

$W_a + W_g$ (kW)	t_i (°C)	q_{min} (ℓ/min)	p_i (atm)	t_o (°C)
10	20	6.0	0.25	46
8	20	4.5	0.15	49
6	20	3.0	0.07	53
10	50	9.0	0.52	67
8	50	6.7	0.31	69
6	50	4.5	0.15	72

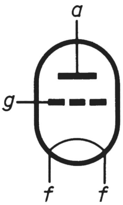
At water inlet temperatures between 20 °C and 50 °C the required quantity of water can be found by linear interpolation.

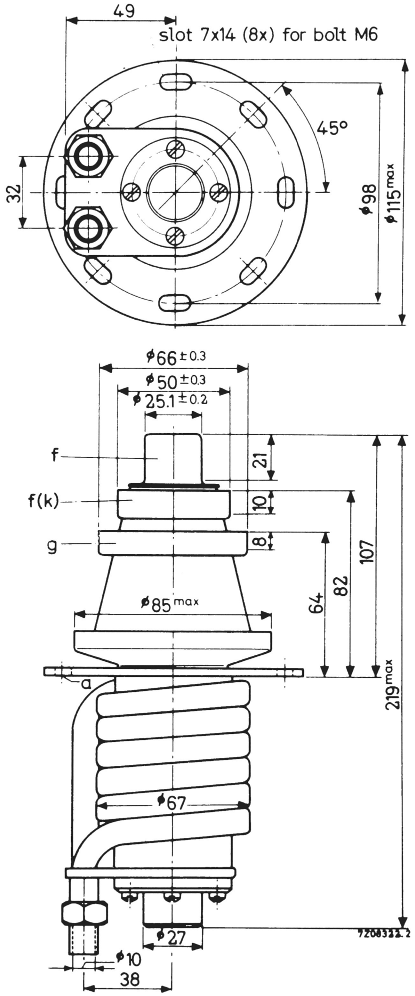
At frequencies higher than 4 MHz air cooling of the seals is required.

MECHANICAL DATA

Dimensions in mm

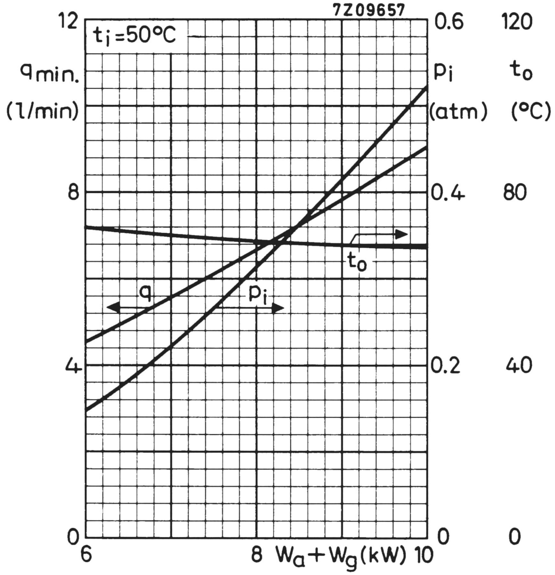
Net weight approx. 2 kg

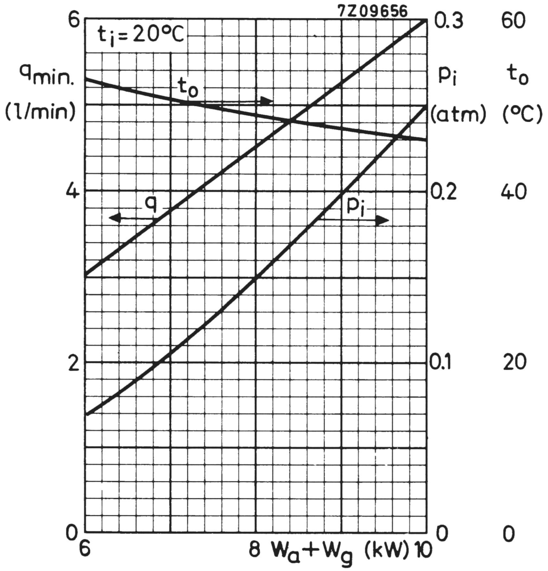



49
slot 7x14 (8x) for bolt M6
45°
32
ϕ98
ϕ115 max
ϕ66 ±0.3
ϕ50 ±0.3
ϕ25.1 ±0.2
f
f(k)
g
21
10
8
64
82
107
219 max
ϕ85 max
a
ϕ67
ϕ27
ϕ10
38
7Z08322.2

Mounting position: vertical with anode up or down

For further data and curves please refer to type YD1170


7Z09657
$t_i = 50$°C
12
8
4
0
$q_{min.}$
(l/min)
0.6
0.4
0.2
0
p_i
(atm)
120
80
40
0
t_o
(°C)
q
p_i
t_o
6
8
10
$W_a + W_g$ (kW)


7Z09656
$t_i = 20$°C
6
4
2
0
$q_{min.}$
(l/min)
0.3
0.2
0.1
0
p_i
(atm)
60
40
20
0
t_o
(°C)
t_o
q
p_i
6
8
10
$W_a + W_g$ (kW)

AIR COOLED R.F. INDUSTRIAL POWER TRIODE

Forced air cooled triode of ceramic-metal construction, intended for use as industrial oscillator.

QUICK REFERENCE DATA

Frequency	f	up to	50	MHz
Anode voltage	V_a		10	kV
Anode current	I_a		1.75	A
Oscillator output power	W_{osc}		13.22	kW

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f		5.4	V	+ 5% –10%
Filament current	I_f		65	A	
Peak filament starting current	I_{fp}	max.	400	A	
Cold filament resistance	R_{fo}		0.01	Ω	

CAPACITANCES

Anode to filament	C_{af}	0.4	pF
Grid filament	C_{gf}	42	pF
Anode to grid	C_{ag}	17	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	10	kV
Anode current	I_a	0.8	A
Mutual conductance	S	14	mA/V
Amplification factor	μ	45	

TEMPERATURE LIMITS (Absolute limits)

Envelope temperature	t_{env}	= max.	240	^oC
Recommended max. envelope temperature under continuously loaded conditions	t_{env}	= max.	200	^oC
Air inlet temperature	t_i	= max.	45	^oC

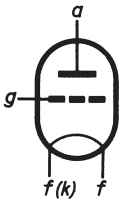
COOLING CHARACTERISTICS (See also cooling curves)

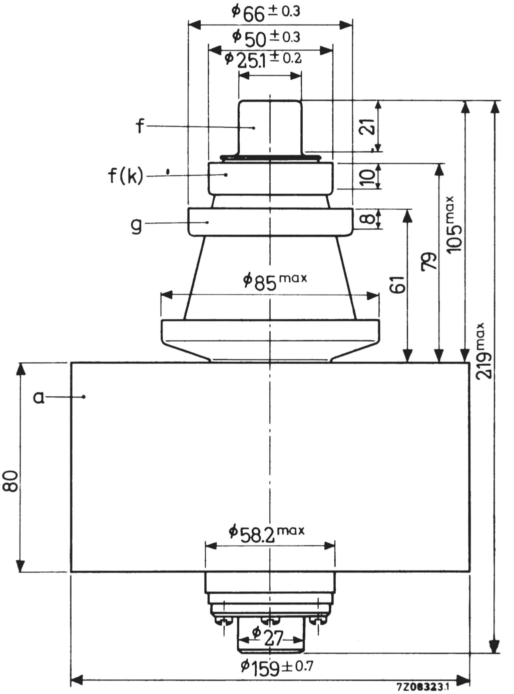
W_a+W_g (kW)	h (m)	t_i (^oC)	q_{min} (m^3/min)	p_i (mm H_2O)	t_o (^oC)
10	0	35	9.5	55	94
8	0	35	6.5	28	105
6	0	35	4.5	15	113
4	0	35	3.0	8	117
10	0	45	11	69	98
8	0	45	7.6	35	108
6	0	45	5.2	19	115
4	0	45	3.5	10	119
10	1500	35	11.4	63	94
8	1500	35	7.8	32	105
6	1500	35	5.5	17	113
4	1500	35	3.6	9	117
10	3000	25	12	62	90
8	3000	25	8.2	32	102
6	3000	25	5.7	17	111
4	3000	25	3.8	9	116

MECHANICAL DATA

Dimensions in mm

Net weight: approx. 7.5 kg




ϕ66 ± 0.3
ϕ50 ± 0.3
ϕ25.1 ± 0.2
f
f(k)
g
21
10
8
61
79
105 max
219 max
ϕ85 max
a
80
ϕ58.2 max
ϕ27
ϕ159 ± 0.7
7Z08323.1

Mounting position: vertical with anode up or down

ACCESSORIES

Insulating pedestal		40654	net weight 4.25 kg
Grid connector	f ≦ 4 MHz	40690	55 g
	f > 4 MHz	40691	240 g
Filament connector (both types required)		40692	140 g
	and	40693	165 g
Filament cables (2x)		40715	200 g

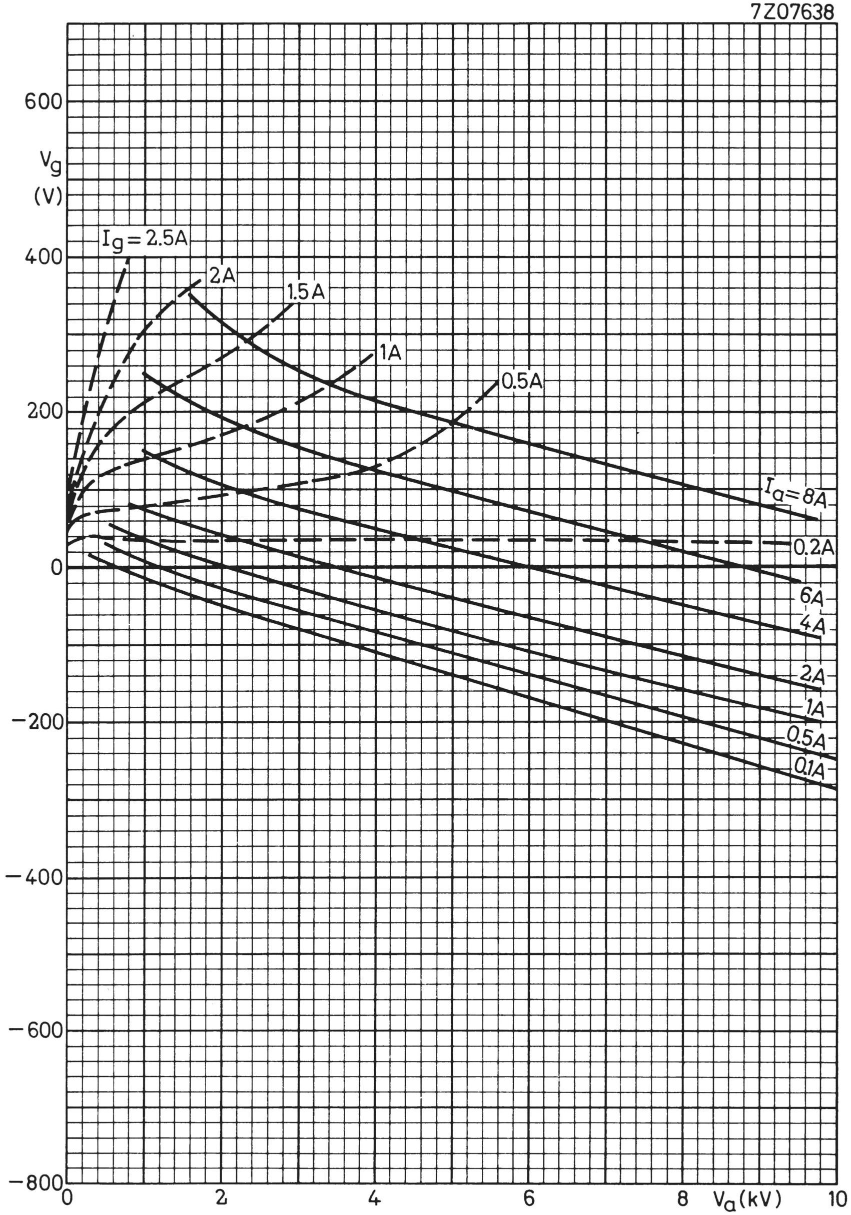
R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

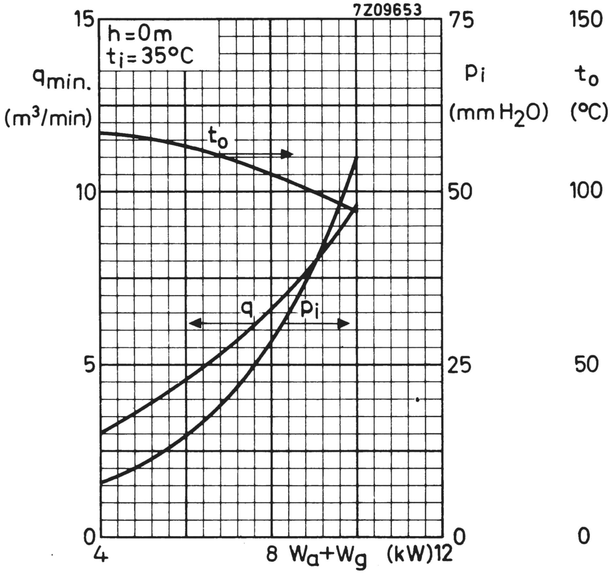
LIMITING VALUES (Absolute max. rating system)

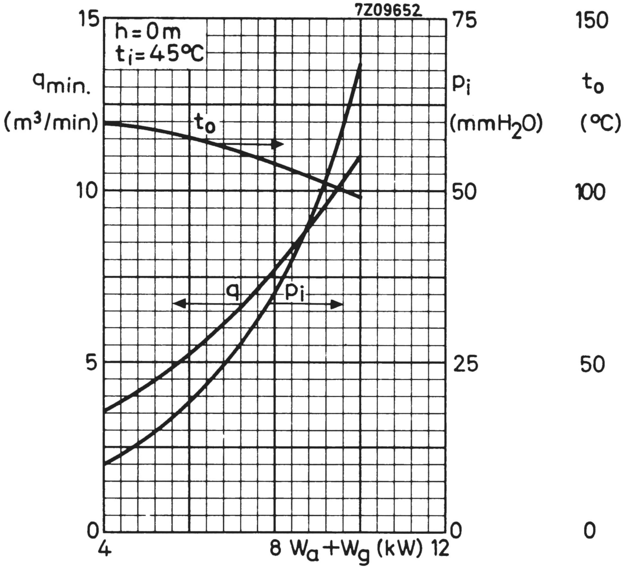
Frequency	f	up to	50	MHz
Anode voltage	V_a	max.	12	kV
Anode current	I_a	max.	2.0	A
Anode input power	W_{i_a}	max.	20	kW
Anode dissipation	W_a	max.	10	kW
Grid voltage	$-V_g$	max.	1.5	kV
Grid current, loaded	I_g	max.	0.6	A
unloaded	I_g	max.	0.8	A
Grid dissipation	W_g	max.	250	W
Grid circuit resistance	R_g	max.	10	kΩ
Cathode current	I_k	max.	2.5	A

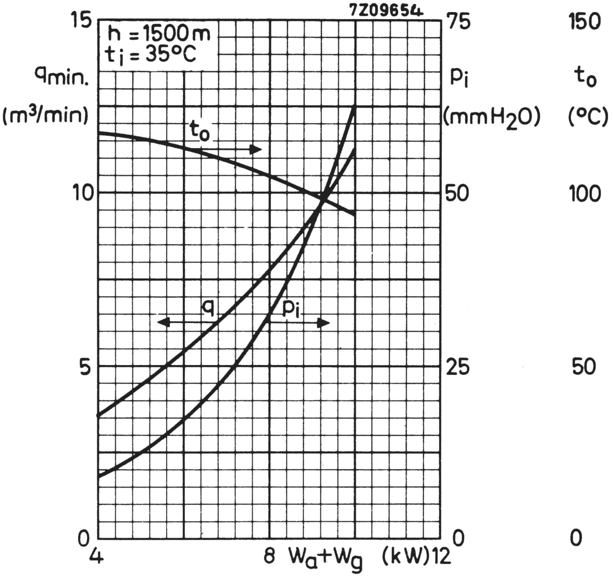
OPERATING CONDITIONS

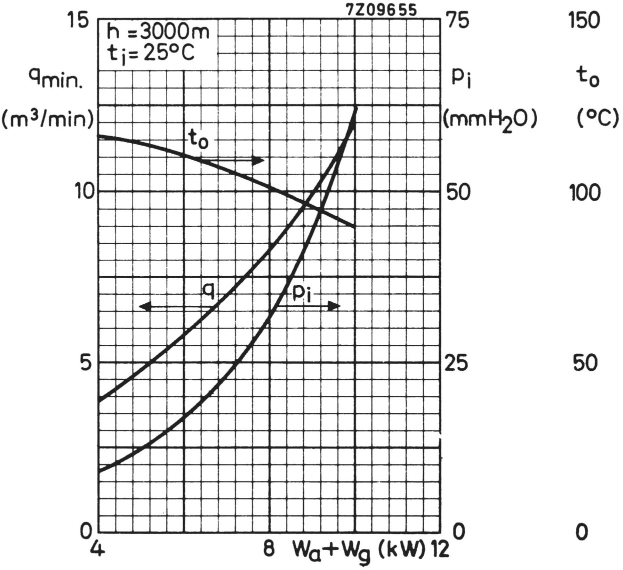
Frequency	f	50	MHz
Anode voltage	V_a	10.0	kV
Anode current	I_a	1.75	A
Anode input power	W_{i_a}	17.5	kW
Anode dissipation	W_a	3.8	kW
Anode output power	W_o	13.7	kW
Anode efficiency	η	78.3	%
Grid resistor	R_g	1.5	kΩ
Grid current, loaded	I_g	450	mA
Grid dissipation	W_g	180	W
Grid resistor dissipation	W_{R_g}	304	W
Oscillator output power	W_{osc}	13.22	kW
Oscillator efficiency	η_{osc}	75.6	%
Feedback ratio	$V_{g\sim}/V_{a\sim}$	12.0	%


7Z07638
600
V_g (V)
400
200
0
−200
−400
−600
−800
0
2
4
6
8
V_a (kV)
10
I_g = 2.5A
2A
1.5A
1A
0.5A
I_a = 8A
0.2A
6A
4A
2A
1A
0.5A
0.1A


7Z09653
h = 0 m
t_i = 35 °C
$q_{min.}$
(m³/min)
p_i
(mm H₂O)
t_o
(°C)
t_o
q
p_i
15
10
5
0
75
50
25
0
150
100
50
0
4
8 W_a+W_g (kW) 12


7Z09652
h = 0 m
t_i = 45 °C
$q_{min.}$
(m³/min)
p_i
(mm H₂O)
t_o
(°C)
t_o
q
p_i
15
10
5
0
75
50
25
0
150
100
50
0
4
8 W_a+W_g (kW) 12


7Z09654
h = 1500 m
t_i = 35°C
$q_{min.}$
(m³/min)
p_i
(mmH₂O)
t_o
(°C)
t_o
q
p_i
15
10
5
0
75
50
25
0
150
100
50
0
4
8
12
W_a+W_g (kW)


7Z09655
h = 3000 m
t_i = 25°C
$q_{min.}$
(m³/min)
p_i
(mmH₂O)
t_o
(°C)
t_o
q
p_i
15
10
5
0
75
50
25
0
150
100
50
0
4
8
12
W_a+W_g (kW)

AIR COOLED
R.F INDUSTRIAL POWER TRIODE

Forced air cooled triode of ceramic-metal construction, intended for use as industrial oscillator.

QUICK REFERENCE DATA

Frequency	f	up to 100	MHz
Anode voltage	V_a	7.5	kV
Anode current	I_a	5.4	A
Oscillator output power	W_{osc}	31.6	kW

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	7	V $^{+5\%}_{-10\%}$
Filament current	I_f	175	A
Peak filament starting current	I_{f_p}	max. 1000	A
Cold filament resistance	R_{f_o}	0.0042	Ω

To maintain a constant cathode temperature as a function of the operating frequency of the tube it may be necessary to decrease the filament voltage at higher frequencies. The quotient of the filament voltage and current should be the same as that when only the filament voltage is applied to the tube.

CAPACITANCES

Anode to filament	C_{af}	1	pF
Grid to filament	C_{gf}	61	pF
Anode to grid	C_{ag}	32	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	7.5	kV
Anode current	I_a	3.2	A
Mutual conductance	S	60	mA/V
Amplification factor	μ	34	

TEMPERATURE LIMITS (Absolute limits)

Absolute max. envelope temperature	t_{env}	max.	240	°C
Recommended max. envelope temperature under continuously loaded conditions	t_{env}	max.	200	°C
Absolute max. air inlet temperature	t_i	max.	45	°C

COOLING CHARACTERISTICS (See also cooling curves)

$W_a + W_g$ (kW)	h (m)	t_i (°C)	q_{min} (m^3/min)	P_i (mm H_2 O)	t_o (°C)
15	0	35	15	85	92
10	0	35	9.3	32	99
8	0	35	7	20	104
15	0	45	17.3	106	98
10	0	45	10.7	40	104
8	0	45	8.1	25	108
15	1500	35	18	97	93
10	1500	35	11.2	46	100
8	1500	35	8.4	23	104
15	3000	25	19	95	90
10	3000	25	11.8	45	95
8	3000	25	8.9	23	99

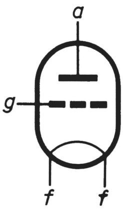
No additional cooling of the seals is required at frequencies < 4 MHz.

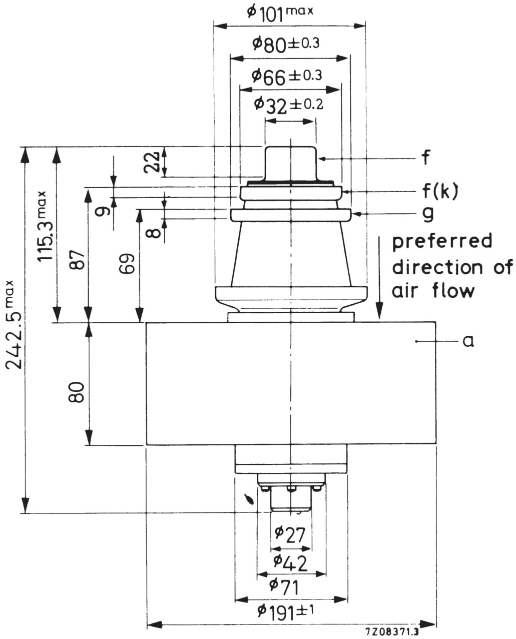
Preferred direction of air flow, especially at the higher operating frequencies: see outline drawing

MECHANICAL DATA

Dimensions in mm ←

Net weight: approx. 12.1 kg




ϕ101 max
ϕ80±0.3
ϕ66±0.3
ϕ32±0.2
22
9
8
69
87
115.3 max
242.5 max
80
f
f(k)
g
preferred direction of air flow
a
ϕ27
ϕ42
ϕ71
ϕ191±1
7Z08371.3

Mounting position: vertical with anode up or down

ACCESSORIES

Insulating pedestal		40648	net weight 7.15 kg
Grid connector	f ≤ 4 MHz	40710	60 g
	f > 4 MHz	40711	310 g
Filament connectors (both types required)		40708	230 g
and		40709	265 g
Filament cables (2x)		40720	215 g

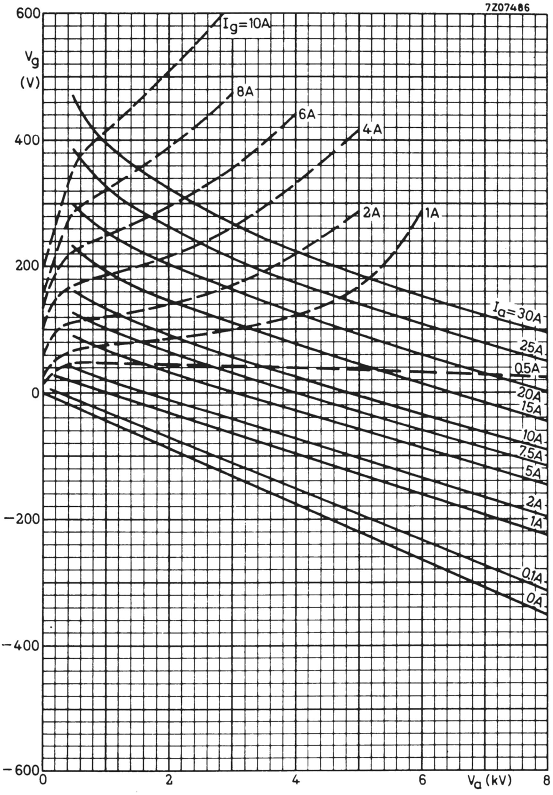
R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

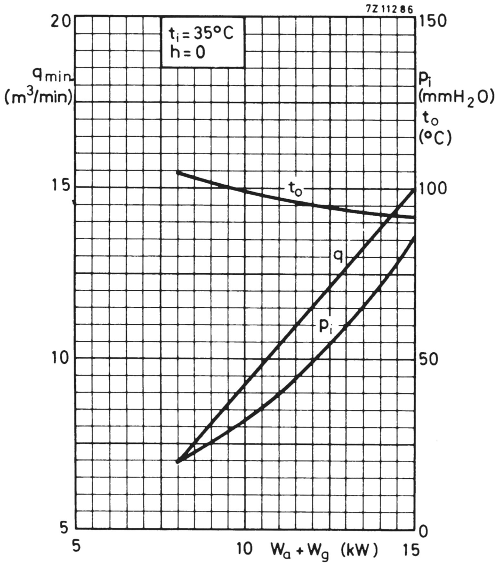
LIMITING VALUES (Absolute max. rating system)

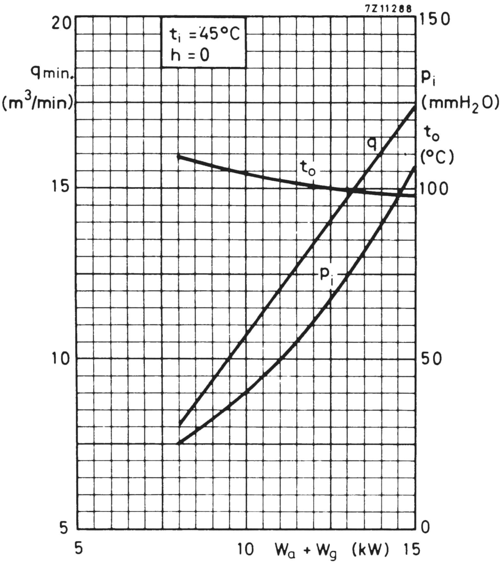
Frequency	f	up to	100	MHz
Anode voltage	V_a	max.	9.0	kV
Anode current	I_a	max.	6.0	A
Anode input power	W_{ia}	max.	45	kW
Anode dissipation	W_a	max.	15	kW
Grid voltage	$-V_g$	max.	1.25	kV
Grid current, loaded	I_g	max.	1.6	A
unloaded	I_g	max.	2.4	A
Grid dissipation	W_g	max.	500	W
Grid circuit resistance	R_g	max.	10	kΩ
Cathode current	I_k	max.	7.5	A

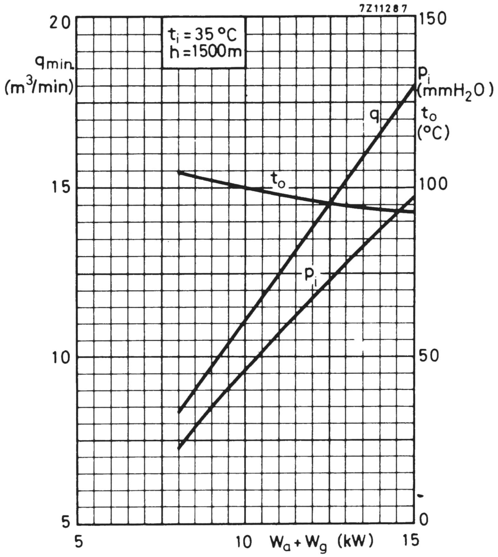
OPERATING CONDITIONS

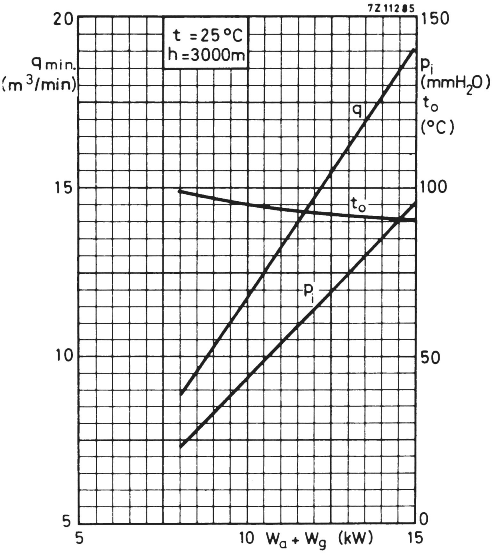
Frequency	f	90	MHz
Filament voltage	V_f	see under "HEATING"	V
Anode voltage	V_a	7.5	kV
Anode current	I_a	5.4	A
Anode input power	W_{i_a}	40.5	kW
Anode dissipation	W_a	7.5	kW
Anode output power	W_o	33.0	kW
Anode efficiency	η	81.5	%
Grid resistor	R_g	450	Ω
Grid currrent, loaded	I_g	1.45	A
Grid dissipation	W_g	450	W
Grid resistor dissipation	W_{R_g}	946	W
Oscillator output power	W_{osc}	31.6	kW
Oscillator efficiency	η_{osc}	78.0	%
Feedback ratio	$V_{g\sim}/V_{a\sim}$	14.8	%


7Z07486
600
V_g
(V)
400
200
0
−200
−400
−600
0
2
4
6
V_a (kV)
8
I_g=10A
8A
6A
4A
2A
1A
I_a=30A
25A
0.5A
20A
15A
10A
7.5A
5A
2A
1A
0.1A
0A


7Z11286
t_i = 35°C
h = 0
q_min
(m³/min)
p_i
(mmH₂O)
t_o
(°C)
t_o
q
p_i
20
15
10
5
150
100
50
0
5
10
W_a + W_g (kW)
15


7Z11288
t_i = 45°C
h = 0
q_min.
(m³/min)
p_i
(mmH₂O)
t_o
(°C)
t_o
q
p_i
20
15
10
5
150
100
50
0
5
10
W_a + W_g (kW)
15


7Z11287
t_i = 35 °C
h = 1500m
q_min
(m³/min)
p_i
(mmH₂O)
t_o
(°C)
q
t_o
p_i
20
15
10
5
150
100
50
0
5
10
W_a + W_g (kW)
15


7Z11285
t = 25 °C
h = 3000m
q_min.
(m³/min)
p_i
(mmH₂O)
t_o
(°C)
q
t_o
p_i
20
15
10
5
150
100
50
0
5
10
W_a + W_g (kW)
15

WATER COOLED R.F. INDUSTRIAL POWER TRIODE

Water cooled triode of ceramic-metal construction with integral water cooler. The tube is intended for use as industrial oscillator.

QUICK REFERENCE DATA				
Frequency	f	up to	100	MHz
Anode voltage	V_a	=	7.5	kV
Anode current	I_a	=	5.4	A
Oscillator output power	W_{osc}	=	31.6	kW

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	7	V	$^{+5\%}_{-10\%}$
Filament current	I_f	=	175	A	
Peak filament starting current	I_{f_p}	= max.	1000	A	
Cold filament resistance	R_{f_o}	=	0.0042	Ω	

To maintain a constant cathode temperature as a function of the operating frequency of the tube it may be necessary to decrease the filament voltage at higher frequencies. The quotient of the filament voltage and current should be the same as that when only the filament voltage is applied to the tube.

CAPACITANCES

Anode to filament	C_{af}	=	1	pF
Grid to filament	C_{gf}	=	61	pF
Anode to grid	C_{ag}	=	32	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	7.5	kV
Anode current	I_a	=	3.2	A
Mutual conductance	S	=	60	mA/V
Amplification factor	μ	=	34	

TEMPERATURE LIMITS (Absolute limits)

Absolute max. envelope temperature	t_{env}	max.	240	°C
Recommended max. envelope temperature under continuously loaded conditions	t_{env}	max.	200	°C
Absolute max. water inlet temperature	t_i	max.	50	°C

WATER COOLING CHARACTERISTICS (See also cooling curves)

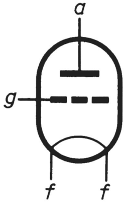
$W_a + W_g$ (kW)	t_i (°C)	q_{min} (l/min)	p_i (atm)	t_o (°C)
20	20	10	0.7	51
	50	15	1.3	71
15	20	7	0.37	54
	50	10.5	0.7	73
10	20	4.5	0.17	58
	50	6.7	0.32	75

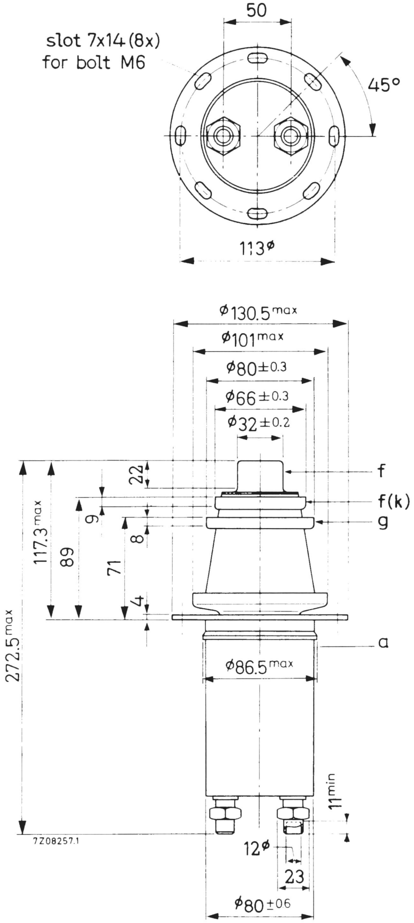
No additional cooling of the seals is required at frequencies < 4 MHz.

MECHANICAL DATA

Dimensions in mm

Net weight: approx. 3 kg




50
slot 7x14 (8x)
for bolt M6
45°
113ϕ
ϕ130.5max
ϕ101max
ϕ80±0.3
ϕ66±0.3
ϕ32±0.2
22
9
8
4
71
89
117.3max
272.5max
f
f(k)
g
a
ϕ86.5max
11min
12ϕ
23
ϕ80±06
7Z08257.1

Mounting position: vertical with anode up or down

ACCESSORIES

Grid connector	f ≦ 4 MHz	40710	net weight	60 g
	f > 4 MHz	40711		310 g
Filament connectors (both types required)		40708		230 g
	and	40709		265 g
Filament cables (2x)		40720		215 g

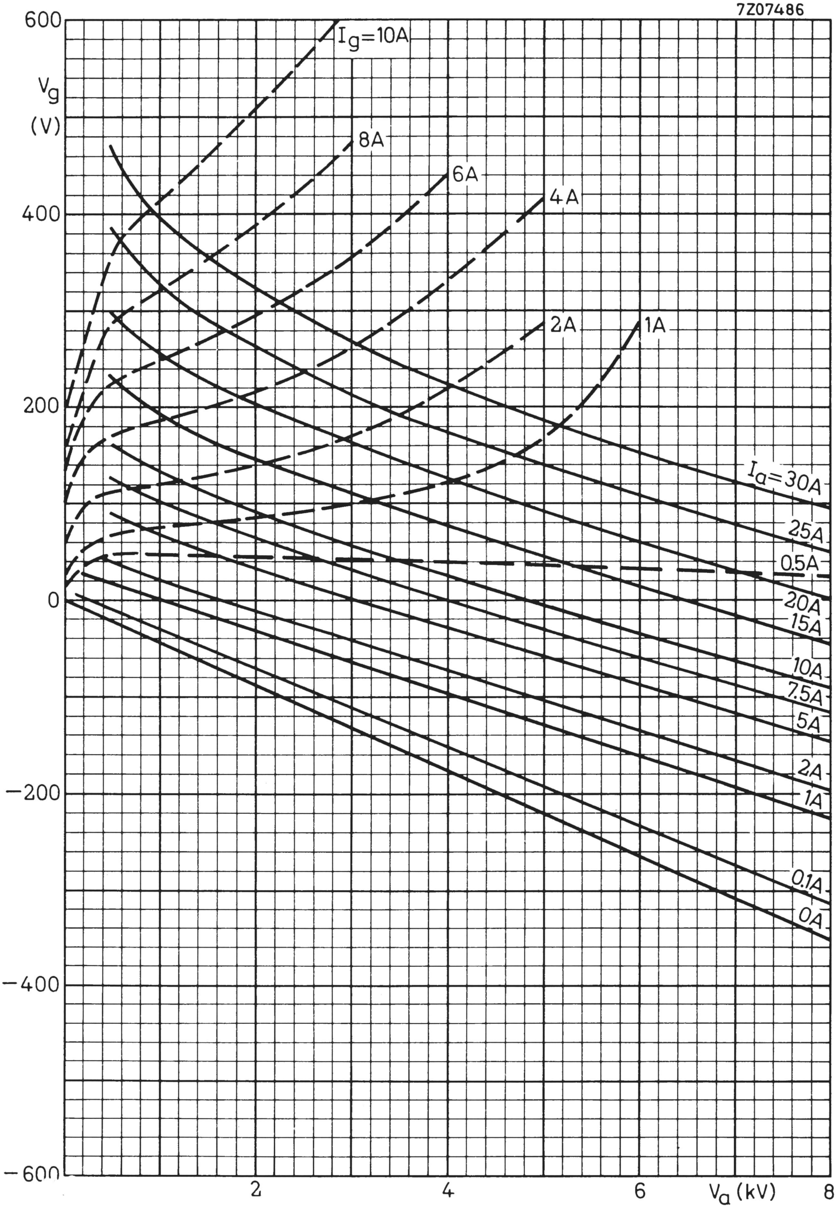
R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

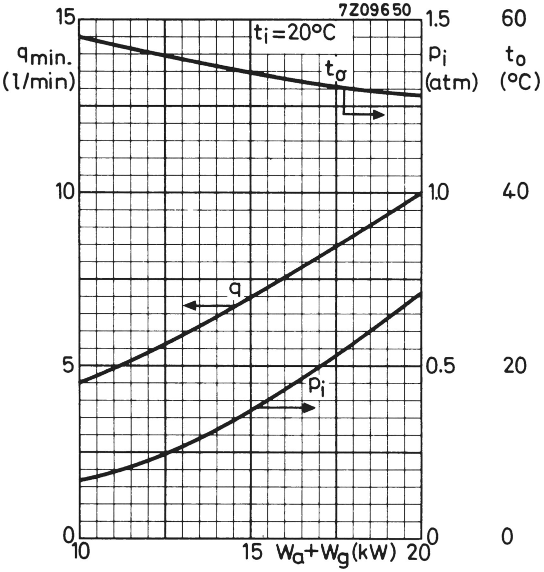
LIMITING VALUES (Absolute max. rating system)

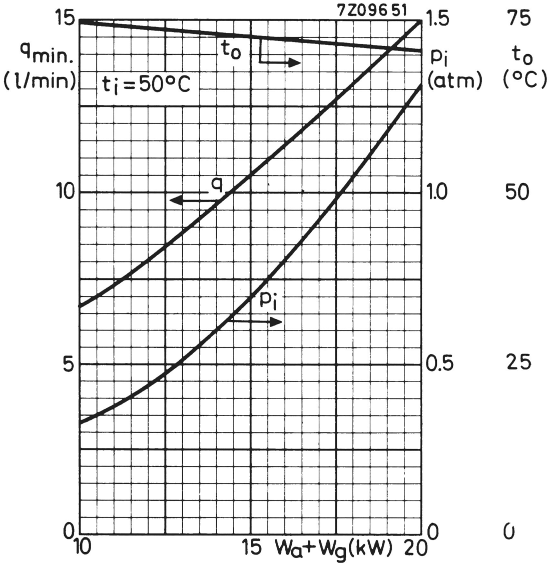
Frequency	f	up to	100	MHz
Anode voltage	V_a	max.	9.0	kV
Anode current	I_a	max.	6.0	A
Anode input power	W_{i_a}	max.	45	kW
Anode dissipation	W_a	max.	20	kW
Grid voltage	$-V_g$	max.	1.25	kV
Grid current, loaded	I_g	max.	1.6	A
unloaded	I_g	max.	2.4	A
Grid dissipation	W_g	max.	500	W
Grid circuit resistance	R_g	max.	10	kΩ
Cathode current	I_k	max.	7.5	A

OPERATING CONDITIONS

Frequency	f	90	MHz
Filament voltage	V_f	see under "HEATING"	V
Anode voltage	V_a	7.5	kV
Anode current	I_a	5.4	A
Anode input power	W_{i_a}	40.5	kW
Anode dissipation	W_a	7.5	kW
Anode output power	W_o	33.0	kW
Anode efficiency	η	81.5	%
Grid resistor	R_g	450	Ω
Grid current, loaded	I_g	1.45	A
Grid dissipation	W_g	450	W
Grid resistor dissipation	W_{R_g}	946	W
Oscillator output power	W_{osc}	31.6	kW
Oscillator efficiency	η_{osc}	78.0	%
Feedback ratio	$V_{g\sim}/V_{a\sim}$	14.8	%


7Z07486
600
400
200
0
−200
−400
−600
V_g (V)
2
4
6
8
V_a (kV)
I_g=10A
8A
6A
4A
2A
1A
I_a=30A
25A
0.5A
20A
15A
10A
7.5A
5A
2A
1A
0.1A
0A


7Z09650
$t_i = 20\,^\circ C$
$q_{min.}$ (l/min)
p_i (atm)
t_o (°C)
t_o
q
p_i
15
10
5
0
1.5
1.0
0.5
0
60
40
20
0
10
15
20
$W_a + W_g$ (kW)


7Z09651
$t_i = 50\,^\circ C$
$q_{min.}$ (l/min)
p_i (atm)
t_o (°C)
t_o
q
p_i
15
10
5
0
1.5
1.0
0.5
0
75
50
25
0
10
15
20
$W_a + W_g$ (kW)

AIR COOLED
R.F. INDUSTRIAL POWER TRIODE

Forced air cooled triode in metal-ceramic construction. The tube is intended for use as industrial oscillator.

QUICK REFERENCE DATA

Frequency	f	up to 30	MHz
Anode voltage	V_a	8	kV
Anode current	I_a	10	A
Oscillator power output	W_{osc}	62.7	kW

HEATING: direct, filament thoriated tungsten

Filament voltage	V_f		8.4	V $^{+5\%}_{-10\%}$
Filament current	I_f		235	A
Filament peak starting current	I_{f_p}	max.	1500	A
Cold filament resistance	R_{f_o}		0.0039	Ω

CAPACITANCES

Anode to filament	C_{af}	1.3	pF
Grid to filament	C_{g_f}	100	pF
Anode to grid	C_{a_g}	45	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	8	kV
Anode current	I_a	6	A
Transconductance	S	90	mA/V
Amplification factor	μ	35	

TEMPERATURE LIMITS

Absolute max. envelope temperature	t_{env}	max.	240	°C
Recommended max. envelope temperature under continuously loaded conditions	t_{env}	max.	200	°C
Absolute max. air inlet temperature	t_i	max.	45	°C

COOLING CHARACTERISTICS (See also cooling curves)

$W_a + W_g$ (kW)	h (m)	t_i (°C)	$q_{min.}$ (m^3/min)	p_i (mmH_2O)
30	0	25	36	190
20	0	25	15	40
30	0	35	42	265
20	0	35	17	50

For frequencies > 4 MHz air cooling of the seals is required.

Preferred direction of air flow: see outline drawing.

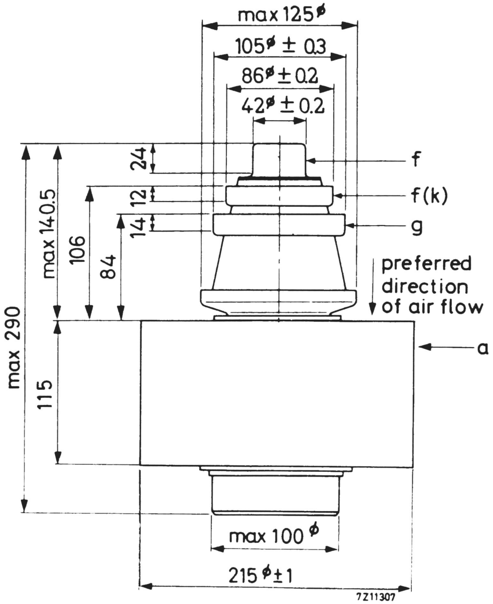
ACCESSORIES

Grid connector	< 4 MHz	type 40707	net weight 75 g
Grid connector	> 4 MHz	type 40736	net weight 450 g
Filament connectors (both types required)		type 40706 and type 40705	net weight 390 g net weight 330 g
Filament cables		type 40718 and type 40719	net weight 460 g net weight 475 g
Insulating pedestal		type 40729	net weight 8.2 kg

MECHANICAL DATA Dimensions in mm

Net weight: approx. 20 kg

Mounting position: vertical with anode up or down


max 125ϕ
105ϕ ± 0.3
86ϕ ± 0.2
42ϕ ± 0.2
24
12
14
max 140.5
106
84
max 290
115
f
f(k)
g
preferred direction of air flow
a
max 100 ϕ
215 ϕ ± 1
7Z11307

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

LIMITING VALUES (Absolute max. rating system)

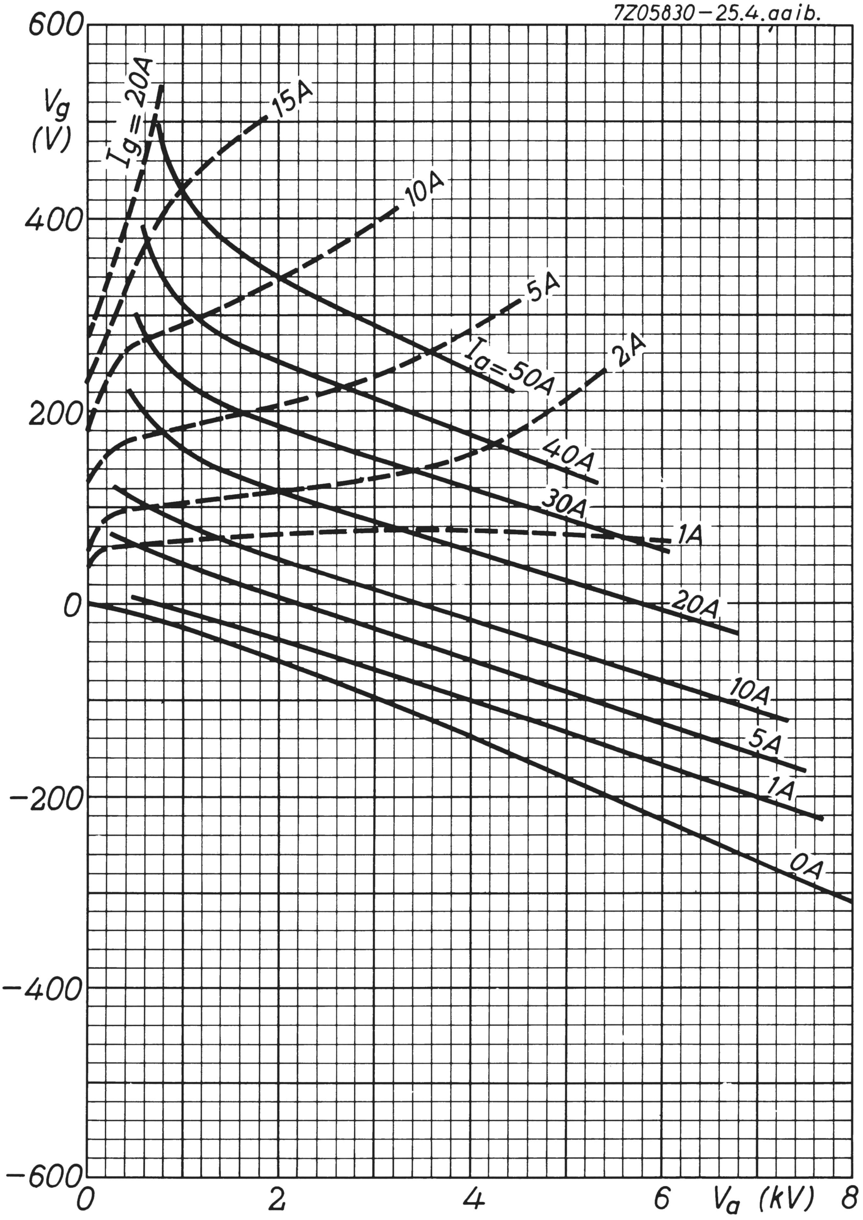
Frequency	f	up to	100	MHz [1]
Anode voltage	V_a	max.	9.6	kV
Anode current	I_a	max.	12	A
Anode input power	W_{ia}	max.	96	kW
Anode dissipation	W_a	max.	30	kW
Grid voltage	$-V_g$	max.	1.5	kV
Grid current, loaded	I_g	max.	2.5	A
unloaded	I_g	max.	3.5	A
Grid dissipation	W_g	max.	1.0	kW
Grid circuit resistance	R_g	max.	10	kΩ
Cathode current	I_k	max.	14	A

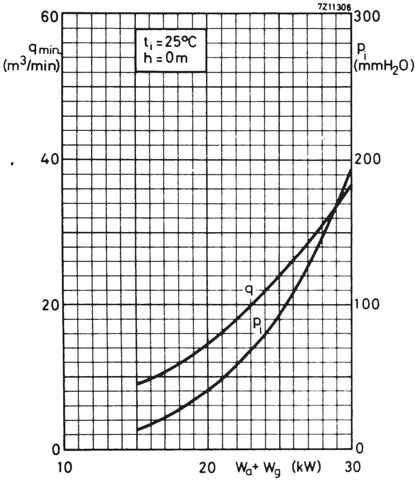
OPERATING CONDITIONS

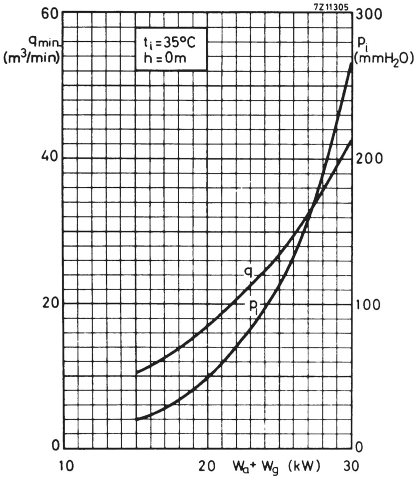
Frequency	f	30	MHz
Anode voltage	V_a	8.0	kV
Anode current	I_a	10	A
Anode input power	W_{i_a}	80.0	kW
Anode dissipation	W_a	15.0	kW
Anode output power	W_o	65.0	kW
Anode efficiency	η	81.2	%
Grid resistor	R_g	300	Ω
Grid current, loaded	I_g	2.25	A
Grid dissipation	W_g	750	W
Grid resistor dissipation	W_{R_g}	1.52	kW
Oscillator output power	W_{osc}	62.7	kW
Oscillator efficiency	η_{osc}	78.4	%
Feedback ratio	$V_{g\sim}/V_{a\sim}$	14.6	%

---

1) When the tubes are to be used at frequencies above 30 MHz the manufacturer should be consulted for more detailed information.


7Z05830-25.4.aaib.
V_g (V)
600
400
200
0
-200
-400
-600
0
2
4
6
8
V_a (kV)
I_g = 20A
15A
10A
5A
2A
1A
I_a = 50A
40A
30A
20A
10A
5A
1A
0A


7Z11306
q_{min}
(m^3/min)
60
40
20
0
$t_i = 25°C$
$h = 0 m$
p_i
(mmH_2O)
300
200
100
0
q
p_i
10
20
$W_a + W_g$ (kW)
30


7Z11305
q_{min}
(m^3/min)
60
40
20
0
$t_i = 35°C$
$h = 0 m$
p_i
(mmH_2O)
300
200
100
0
q
p_i
10
20
$W_a + W_g$ (kW)
30

WATER COOLED
R.F. INDUSTRIAL POWER TRIODE

Water cooled triode in metal-ceramic construction with integral water cooler. The tube is intended for use as industrial oscillator.

QUICK REFERENCE DATA

Frequency	f	up to 30	MHz
Anode voltage	V_a	8	kV
Anode current	I_a	10	A
Oscillator power output	W_{osc}	62.7	kW

HEATING: direct, filament thoriated tungsten

Filament voltage	V_f		8.4	V $^{+\ 5\%}_{-10\%}$
Filament current	I_f		235	A
Filament peak starting current	I_{f_p}	max.	1500	A
Cold filament resistance	R_{f_o}		0.0039	Ω

CAPACITANCES

Anode to filament	C_{af}	1.3	pF
Grid to filament	C_{gf}	100	pF
Anode to grid	C_{ag}	45	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	8	kV
Anode current	I_a	6	A
Transconductance	S	90	mA/V
Amplification factor	μ	35	

TEMPERATURE LIMITS

Absolute max. envelope temperature	t_{env}	max.	240	°C
Recommended max. envelope temperature under continuously loaded conditions	t_{env}	max.	200	°C
Absolute max. water inlet temperature	t_i	max.	50	°C

COOLING CHARACTERISTICS (See also cooling curves)

W_a+W_g (kW)	t_i (°C)	q_{min} (l/min.)	p_i (atm)	t_o (°C)
40	20	20	0.7	51
	50	30	1.3	70
30	20	14	0.37	53
	50	21	0.7	72
20	20	9	0.17	56
	50	13.5	0.32	74

For frequencies > 4 MHz air cooling of the seals is required.

ACCESSORIES

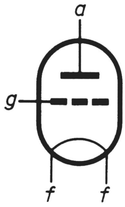
Grid connector < 4 MHz	type	40707	net weight	75	g
Grid connector > 4 MHz	type	40736	net weight	450	g
Filament connectors	type	40706	net weight	390	g
(both types required)	and type	40705	net weight	330	g
Filament cables	type	40718	net weight	460	g
	and type	40719	net weight	475	g

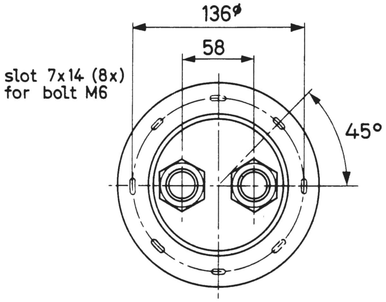
MECHANICAL DATA Dimensions in mm

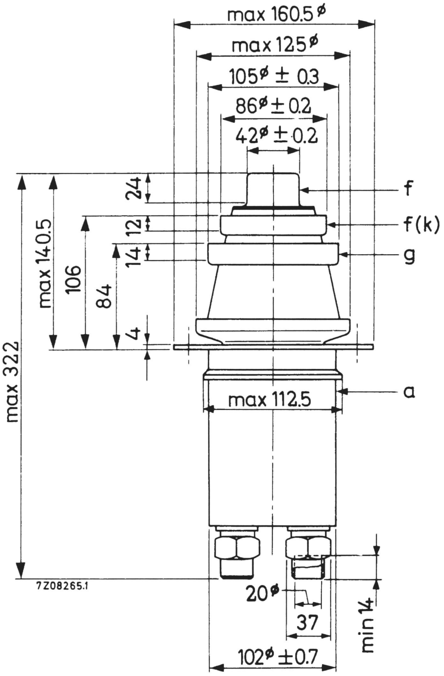
Net weight approx. 6 kg

Mounting position: vertical with anode up or down

With anode up the water inlet and outlet connections should be interchanged.




136ø
58
slot 7x14 (8x)
for bolt M6
45°


max 160.5ø
max 125ø
105ø ± 0.3
86ø ± 0.2
42ø ± 0.2
24
12
14
4
max 140.5
106
84
max 322
f
f(k)
g
a
max 112.5
7Z08265.1
20ø
37
min 14
102ø ± 0.7

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

LIMITING VALUES (Absolute max. rating system)

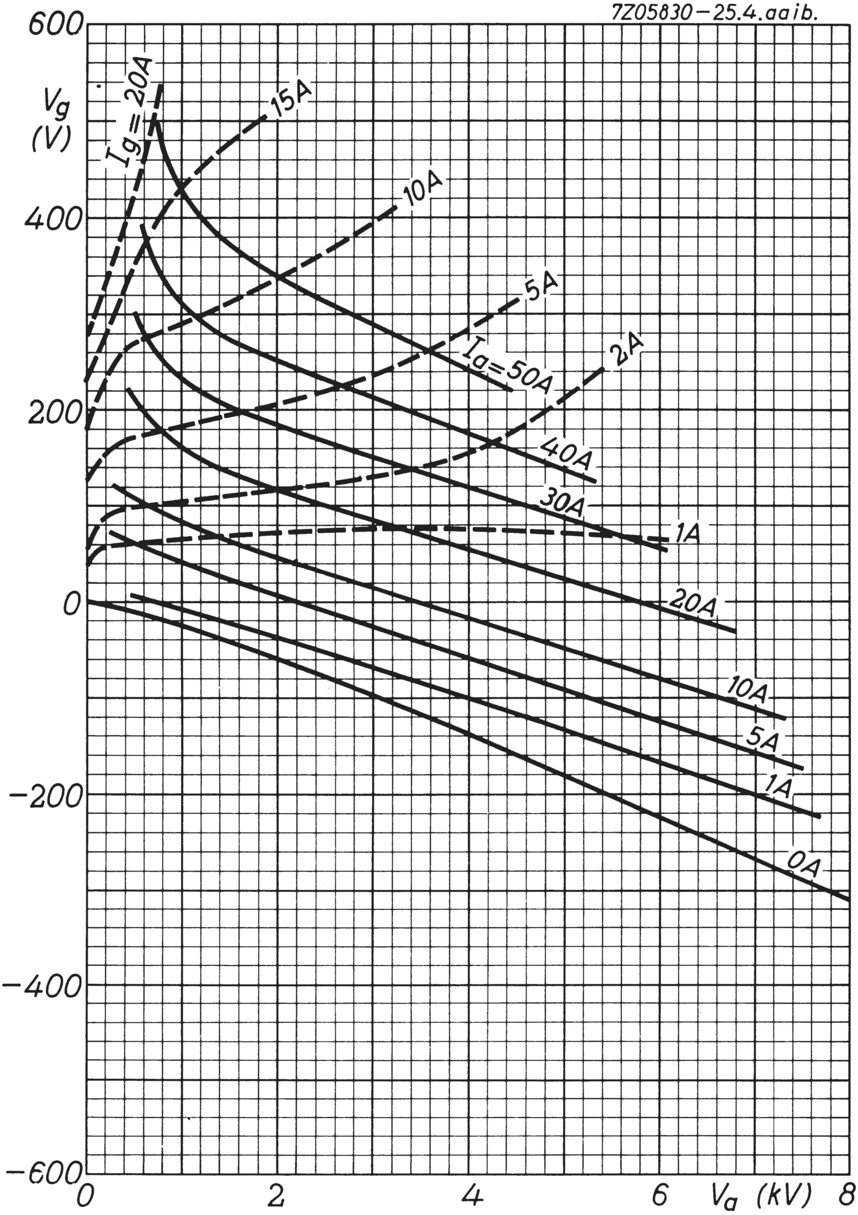
Frequency	f	up to	100	MHz [1]
Anode voltage	V_a	max.	9.6	kV
Anode current	I_a	max.	12	A
Anode input power	W_{i_a}	max.	96	kW
Anode dissipation	W_a	max.	40	kW
Grid voltage	$-V_g$	max.	1.5	kV
Grid current, loaded	I_g	max.	2.5	A
unloaded	I_g	max.	3.5	A
Grid dissipation	W_g	max.	1.0	kW
Grid circuit resistance	R_g	max.	10	kΩ
Cathode current	I_k	max.	14	A

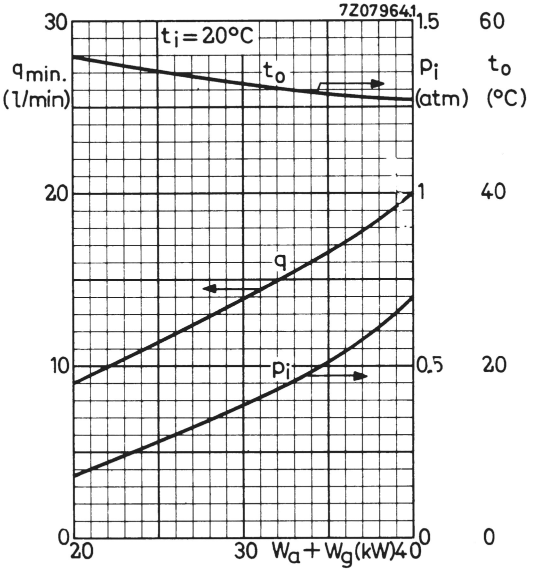
OPERATING CONDITIONS

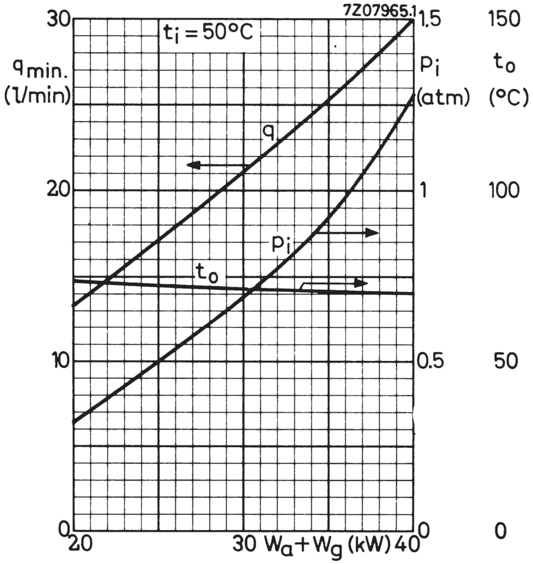
Frequency	f	30	MHz
Anode voltage	V_a	8.0	kV
Anode current	I_a	10	A
Anode input power	W_{ia}	80.0	kW
Anode dissipation	W_a	15.0	kW
Anode output power	W_o	65.0	kW
Anode efficiency	η	81.2	%
Grid resistor	R_g	300	Ω
Grid current, loaded	I_g	2.25	A
Grid dissipation	W_g	750	W
Grid resistor dissipation	W_{R_g}	1.52	kW
Oscillator output power	W_{osc}	62.7	kW
Oscillator efficiency	η_{osc}	78.4	%
Feedback ratio	$V_{g\sim}/V_{a\sim}$	14.6	%

---

1) When the tubes are to be used at frequencies above 30 MHz the manufacturer should be consulted for more detailed information.


7Z05830-25.4.aaib.
600
400
200
0
-200
-400
-600
V_g (V)
0
2
4
6
V_a (kV)
8
I_g = 20A
15A
10A
5A
2A
1A
I_a = 50A
40A
30A
20A
10A
5A
1A
0A


7Z07964.1
$t_i = 20°C$
$q_{min.}$ (l/min)
30
20
10
0
p_i (atm)
1.5
1
0.5
0
t_o (°C)
60
40
20
0
t_o
q
p_i
20
30
$W_a + W_g$ (kW)
40


7Z07965.1
$t_i = 50°C$
$q_{min.}$ (l/min)
30
20
10
0
p_i (atm)
1.5
1
0.5
0
t_o (°C)
150
100
50
0
q
p_i
t_o
20
30
$W_a + W_g$ (kW)
40

VAPOUR COOLED R.F. INDUSTRIAL POWER TRIODE

Vapour cooled triode for use as industrial oscillator for frequencies up to 30 MHz.

QUICK REFERENCE DATA				
Frequency	f	up to	30	MHz
Anode voltage	V_a		8	kV
Anode current	I_a		10	A
Oscillator output power	W_{osc}		62.7	kW

HEATING: direct, filament thoriated tungsten

Filament voltage	V_f		8.4	$V^{+5\%}_{-10\%}$
Filament current	I_f		235	A
Filament peak starting current	I_{fp}	max.	1500	A
Cold filament resistance	R_{f_o}		3.9	mΩ

CAPACITANCES

Anode to filament	C_{af}	1.3	pF
Grid to filament	C_{gf}	100	pF
Anode to grid	C_{ag}	45	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	8	kV
Anode current	I_a	6	A
Transconductance	S	90	mA/V
Amplification factor	μ	35	

TEMPERATURE LIMITS

Absolute max. envelope temperature	t_{env}	max.	240	°C
Recommended max. envelope temperature under continuous loaded conditions	t_{env}	max.	200	°C

COOLING CHARACTERISTICS (see also cooling curves)

With integrated boiler-condensor type K735

$W_a + W_g$ (kW)	t_i (^oC)	$q_{min.}$ (1/min)	t_o (^oC)	p_i (atm)
40	20	11	74	0.05
	35	15	74	0.07
	50	25	74	0.16
30	20	8	76	0.03
	35	11	76	0.05
	50	17	76	0.09
20	20	5	80	0.02
	35	6.7	80	0.03
	50	10	80	0.04

Low velocity air cooling of the seals is required.

ACCESSORIES

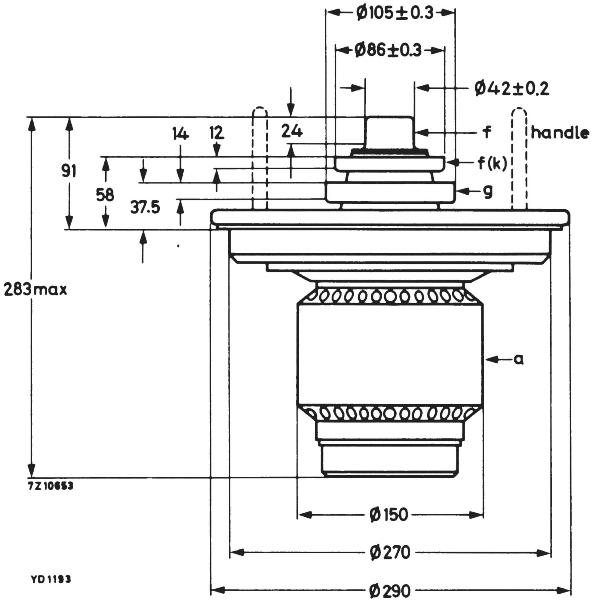
Grid connector	f < 4 MHz	type 40707 net weight	75	g
Grid connector	f > 4 MHz	type 40736 net weight	450	g
Filament connectors		type 40706 net weight	390	g
(both types required)		and type 40705 net weight	330	g
Filament cables		type 40718 net weight	460	g
(both types required)		and type 40719 net weight	475	g
Boiler-condensor		type K735 net weight approx.	70	kg

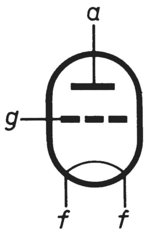
MECHANICAL DATA

Dimensions in mm

Net weight: approx. 15.7 kg

Mounting position: Vertical with anode down.


Ø105±0.3
Ø86±0.3
Ø42±0.2
24
14
12
91
58
37.5
283max
f
f(k)
g
handle
a
Ø150
Ø270
Ø290
7Z10653
YD1193



Note: The handles should be removed before switching on the tube.

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

LIMITING VALUES (Absolute max. rating system)

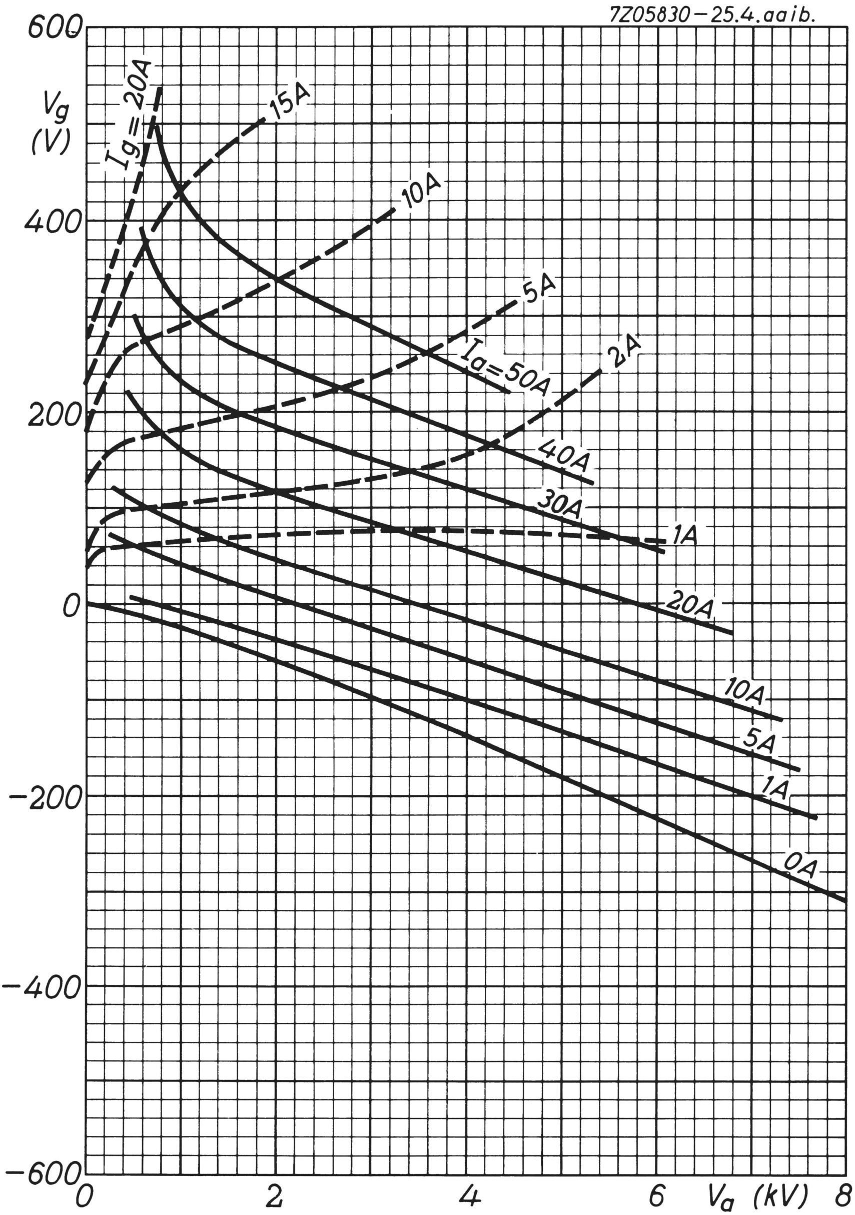
Frequency	f	up to	100	MHz [1]
Anode voltage	V_a	max.	9.6	kV
Anode current	I_a	max.	12	A
Anode input power	W_{i_a}	max.	96	kW
Anode dissipation	W_a	max.	40	kW
Grid voltage	$-V_g$	max.	1.5	kV
Grid current, loaded	I_g	max.	2.5	A
unloaded	I_g	max.	3.5	A
Grid dissipation	W_g	max.	1.0	kW
Cathode current	I_k	max.	14	A
Grid circuit resistance	R_g	max.	10	kΩ

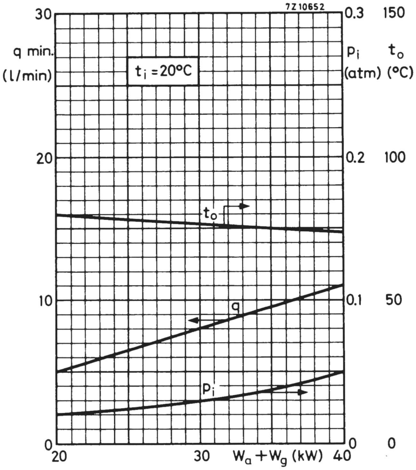
OPERATING CONDITIONS

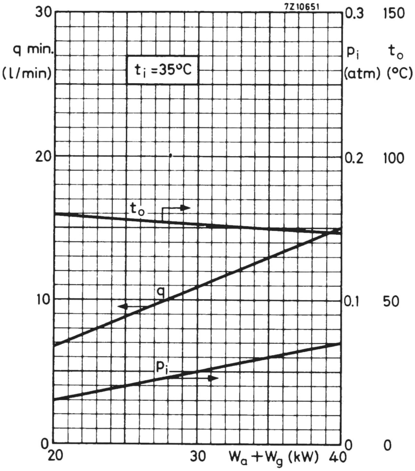
Frequency	f	30	MHz
Anode voltage	V_a	8.0	kV
Anode current	I_a	10	A
Anode input power	W_{i_a}	80.0	kW
Anode dissipation	W_a	15.0	kW
Anode output power	W_o	65.0	kW
Anode efficiency	η	81.2	%
Grid resistor	R_g	300	Ω
Grid current, loaded	I_g	2.25	A
Grid dissipation	W_g	750	W
Grid resistor dissipation	W_{R_g}	1.52	kW
Oscillator output power	W_{osc}	62.7	kW
Oscillator efficiency	$_{osc}$	78.4	%
Feedback ratio	$V_{g\sim}/V_{a\sim}$	14.6	%

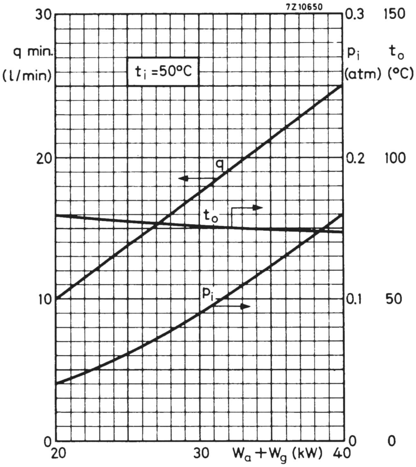
---

[1] When the tube has to be used at frequencies above 30 MHz the manufacturer should be consulted for more detailed information.


7Z05830–25.4.aaib.
600
400
200
0
–200
–400
–600
V_g (V)
I_g = 20A
15A
10A
5A
2A
1A
I_a = 50A
40A
30A
20A
10A
5A
1A
0A
0
2
4
6
V_a (kV)
8


7Z10652
q min.
(l/min)
$t_i = 20°C$
p_i
(atm)
t_o
(°C)
t_o
q
p_i
30
20
10
0
0.3
0.2
0.1
0
150
100
50
0
20
30
$W_a + W_g$ (kW)
40


7Z10651
q min.
(l/min)
$t_i = 35°C$
p_i
(atm)
t_o
(°C)
t_o
q
p_i
30
20
10
0
0.3
0.2
0.1
0
150
100
50
0
20
30
$W_a + W_g$ (kW)
40


7Z10650
q min.
(l/min)
$t_i = 50°C$
p_i
(atm)
t_o
(°C)
q
t_o
p_i
30
20
10
0
0.3
0.2
0.1
0
150
100
50
0
20
30
$W_a + W_g$ (kW)
40

WATER COOLED
R.F. INDUSTRIAL POWER TRIODE

Water cooled triode in metal ceramic construction with integral water cooler. The tube is intended for use as industrial oscillator.

QUICK REFERENCE DATA			
Frequency	f	up to 30	MHz
Anode voltage	V_a	10	kV
Anode current	I_a	16	A
Oscillator power output	W_{osc}	120	kW

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	12.2	V $^{+5\%}_{-10\%}$
Filament current	I_f	250	A
Filament peak starting current	I_{f_p}	max. 1500	A
Cold filament resistance	R_{f_o}	0.0053	Ω

CAPACITANCES

Anode to filament	C_{af}	2.7	pF
Grid to filament	C_{gf}	170	pF
Anode to grid	C_{ag}	55	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	10	kV
Anode current	I_a	8	A
Transconductance	S	150	mA/V
Amplification factor	μ	30	

TEMPERATURE LIMITS

Absolute max. envelope temperature	t_{env}	max.	240	°C
Recommended max. envelope temperature under continuously loaded conditions	t_{env}	max.	200	°C
Absolute max. water inlet temperature	t_i	max.	50	°C

COOLING CHARACTERISTICS (See also cooling curves)

W_a+W_g (kW)	t_i (°C)	q_{min} (l/min.)	p_i (atm)	t_o (°C)
80	20	40	0.35	50
	50	60	0.65	70
60	20	28	0.18	52
	50	42	0.32	72
40	20	18	0.08	54
	50	27	0.15	73

Cooling of the seals can be accomplished by a low velocity air flow, or by water cooling of the filament connectors.
The cooling circuits of these accessories may be connected in series.
A water flow of approximately 0.5 l/min. will be sufficient.

ACCESSORIES

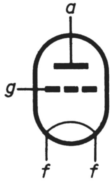
Grid connector < 4 MHz		type	40694	net weight	270 g
Grid connector > 4 MHz		type	40737	net weight	525 g
Filament connectors		type	40695	net weight	710 g
(both types required)	and	type	40696	net weight	860 g
Filament cables		type	40716	net weight	975 g
(both types required)	and	type	40717	net weight	980 g

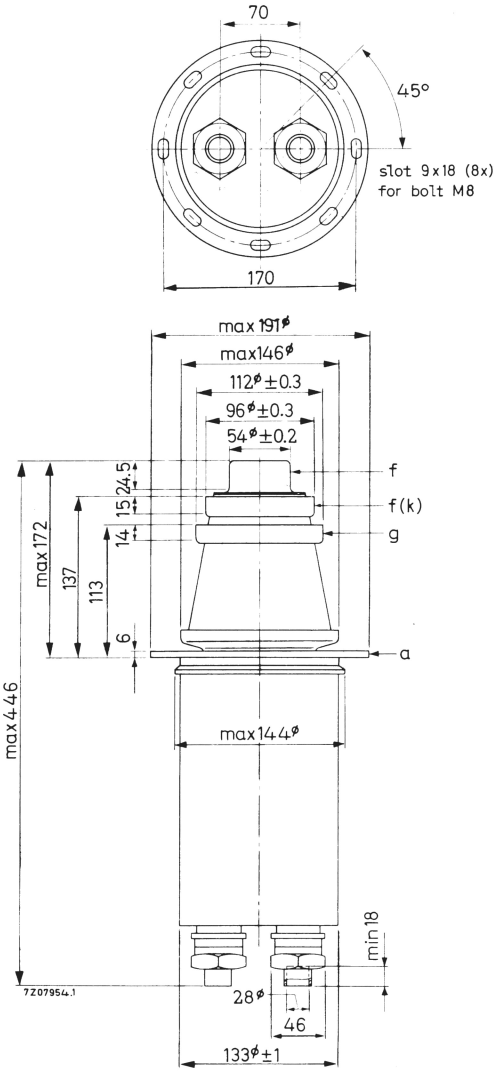
MECHANICAL DATA Dimensions in mm

Net weight approx. 11.5 kg

Mounting position: vertical, anode up or down

With anode up the water inlet and outlet connections should be interchanged.




70
45°
slot 9x18 (8x)
for bolt M8
170
max 191⌀
max146⌀
112⌀±0.3
96⌀±0.3
54⌀±0.2
24.5
15
14
max 172
137
113
6
f
f(k)
g
a
max 446
max144⌀
min 18
7Z07954.1
28⌀
46
133⌀±1

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

LIMITING VALUES (Absolute max. rating system)

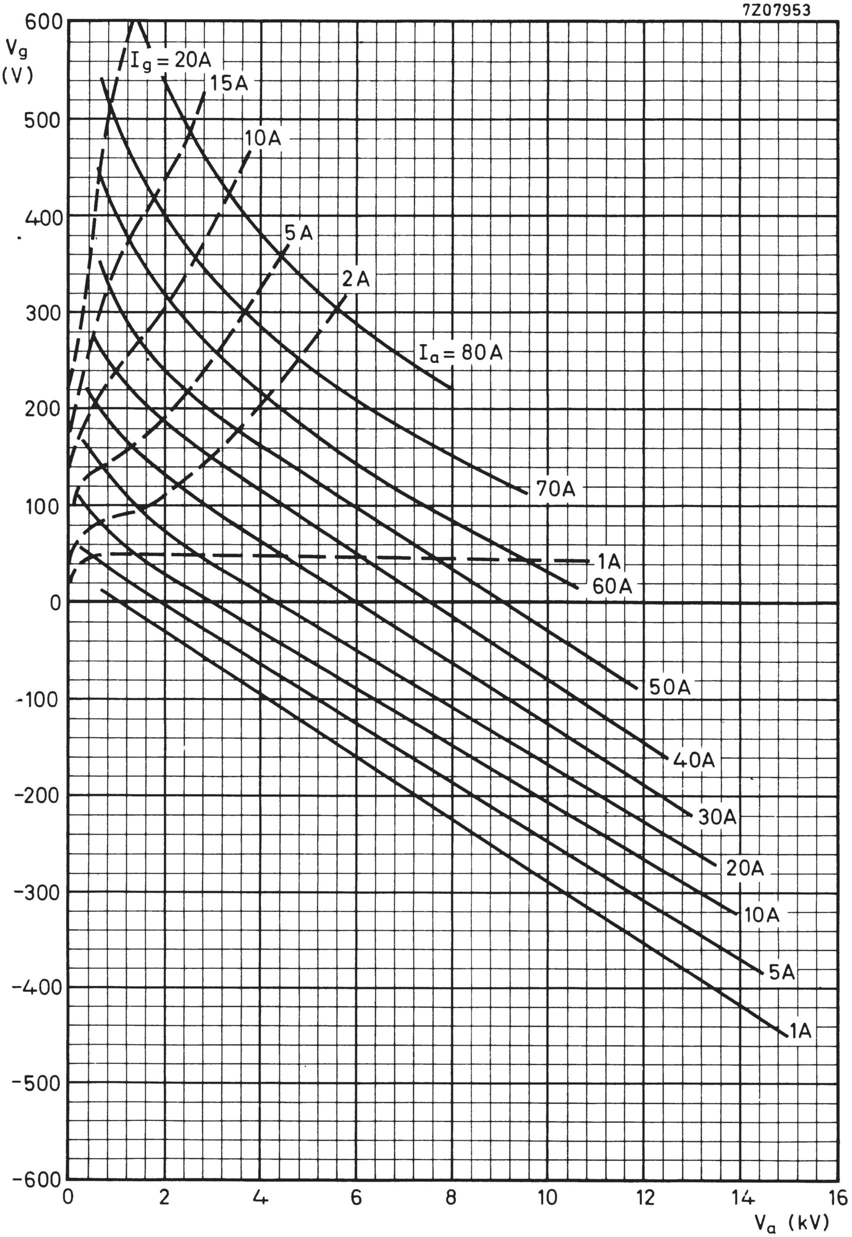
Frequency	f	up to	100	MHz 1)
Anode voltage	V_a	max.	14.4	kV
Anode current	I_a	max.	18.0	A
Anode input power	W_{i_a}	max.	220	kW
Anode dissipation	W_a	max.	80	kW
Grid voltage	$-V_g$	max.	2.0	kV
Grid current, loaded	I_g	max.	4.0	A
unloaded	I_g	max.	5.5	A
Grid dissipation	W_g	max.	2.0	kW
Grid circuit resistance	R_g	max.	10	kΩ
Cathode current	I_k	max.	22	A

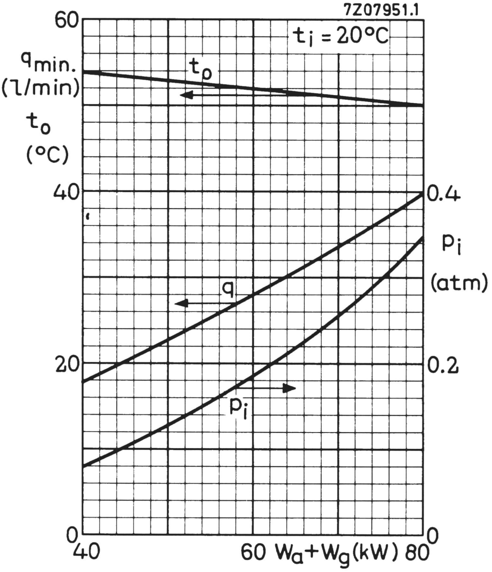
OPERATING CONDITIONS

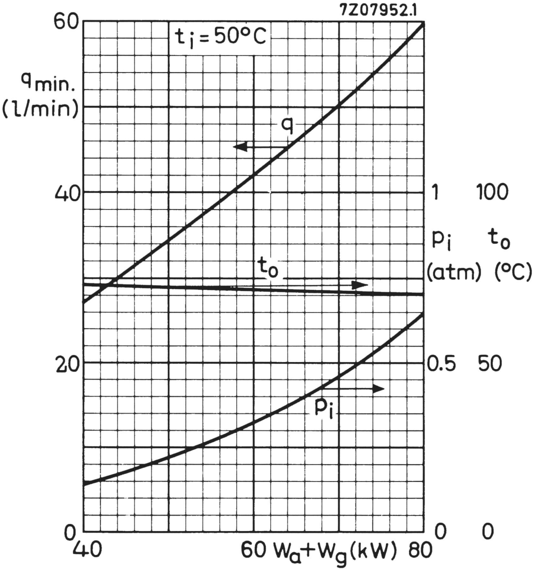
Frequency	f	30	30	MHz
Anode voltage	V_a	10.0	12.0	kV
Anode current	I_a	16.0	13.0	A
Anode input power	W_{i_a}	160	156	kW
Anode dissipation	W_a	36.0	32.5	kW
Anode output power	W_o	124	123.5	kW
Anode efficiency	η	77.5	79.2	%
Grid resistor	R_g	200	330	Ω
Grid current, loaded	I_g	3.5	2.7	A
Grid dissipation	W_g	1.5	1.1	kW
Grid resistor dissipation	W_{R_g}	2.45	2.40	kW
Oscillator output power	W_{osc}	120	120	kW
Oscillator efficiency	η_{osc}	75.0	77.0	%
Feedback ratio	$V_{g\sim}/V_{a\sim}$	12.8	11.6	%

---

1) When the tubes are to be used at frequencies above 30 MHz the manufacturer should be consulted for more detailed information.


7Z07953
V_g (V)
600
500
400
300
200
100
0
-100
-200
-300
-400
-500
-600
I_g = 20A
15A
10A
5A
2A
1A
I_a = 80A
70A
60A
50A
40A
30A
20A
10A
5A
1A
0
2
4
6
8
10
12
14
16
V_a (kV)


7Z07951.1
$t_i = 20°C$
60
40
20
0
$q_{min.}$ (l/min)
t_o (°C)
t_o
q
p_i
p_i (atm)
0.4
0.2
0
40
60 W_a+W_g(kW) 80


7Z07952.1
$t_i = 50°C$
60
40
20
0
$q_{min.}$ (l/min)
q
t_o
p_i
1
100
p_i (atm)
t_o (°C)
0.5
50
0
0
40
60 W_a+W_g(kW) 80

VAPOUR COOLED R.F. INDUSTRIAL POWER TRIODE

Vapour cooled triode for use as industrial oscillator for frequencies up to 30 MHz.

QUICK REFERENCE DATA

Frequency	f	up to	30	MHz
Anode voltage	V_a		10	kV
Anode current	I_a		16	A
Oscillator output power	W_{osc}		120	kW

HEATING: direct, filament thoriated tungsten

Filament voltage	V_f		12.2	$V^{+5\%}_{-10\%}$
Filament current	I_f		255	A
Peak filament starting current	I_{f_p}	max.	1500	A
Cold filament resistance	R_{f_o}		5.3	mΩ

CAPACITANCES

Anode to filament	C_{af}	2.7	pF
Grid to filament	C_{gf}	170	pF
Anode to grid	C_{ag}	55	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	10	kV
Anode current	I_a	8	A
Transconductance	S	150	mA/V
Amplification factor	μ	30	

TEMPERATURE LIMITS

Absolute max. envelope temperature	t_{env}	max.	240	°C
Recommended max. envelope temperature under continuous loaded conditions	t_{env}	max.	200	°C

COOLING CHARACTERISTICS

With integrated boiler-condensor type K735

W_a+W_g (kW)	t_i (°C)	$q_{min.}$ (1/min)	t_o (°C)	P_i (atm)
80	20	29	60	0.20
	35	48	59	0.51
60	20	16	75	0.08
	35	24	72	0.14
	50	45	70	0.45
40	20	10	80	0.04
	35	13.5	80	0.06
	50	20	80	0.10

Cooling of the seals can be accomplished by a low velocity air flow or by watercooling of the filament connectors. The cooling circuit of these accessories may be connected in series. A water flow of approximately 0.51/min. will be sufficient.

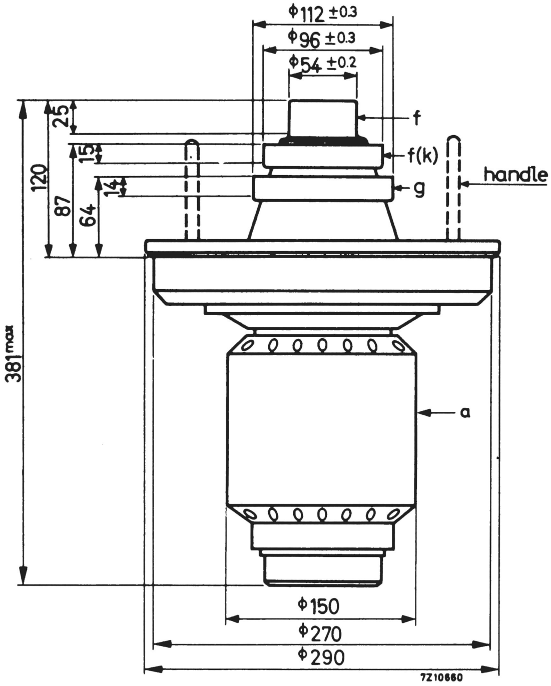
ACCESSORIES

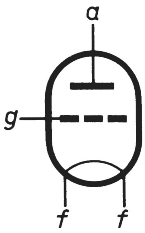
Grid connector	type 40737 net weight	525 g
Filament connectors (both types required)	type 40695 net weight and type 40696 net weight	710 g 860 g
Filament cables (both types required)	type 40716 net weight and type 40717 net weight	975 g 980 g
Boiler-condensor	type K735 net weight approx.	70 kg

MECHANICAL DATA Dimensions in mm

Net weight: approx. 16.7 kg

Mounting position: Vertical with anode down


Φ112 ±0.3
Φ96 ±0.3
Φ54 ±0.2
25
15
14
120
87
64
381 max
f
f(k)
g
handle
a
Φ150
Φ270
Φ290
7Z10660



Note: The handles should be removed before switching on the tube.

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

LIMITING VALUES (Absolute max. rating system)

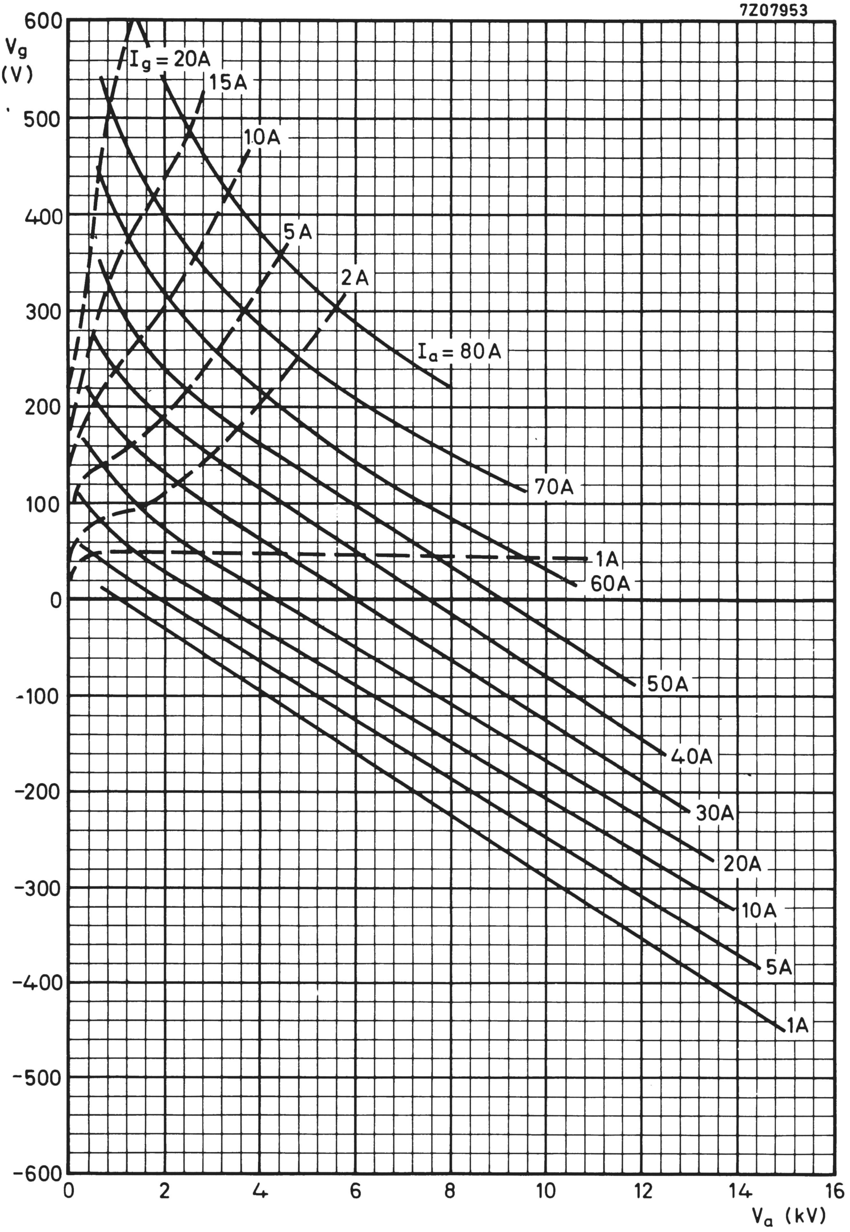
Frequency	f	up to	100	MHz [1]
Anode voltage	V_a	max.	14.4	kV
Anode current	I_a	max.	18	A
Anode input power	W_{ia}	max.	220	kW
Anode dissipation	W_a	max.	80	kW
Grid voltage	$-V_g$	max.	2	kV
Grid current, loaded	I_g	max.	4	A
unloaded	I_g	max.	5.5	A
Grid dissipation	W_g	max.	2	kW
Cathode current	I_k	max.	22	A
Grid circuit resistance	R_g	max.	10	kΩ

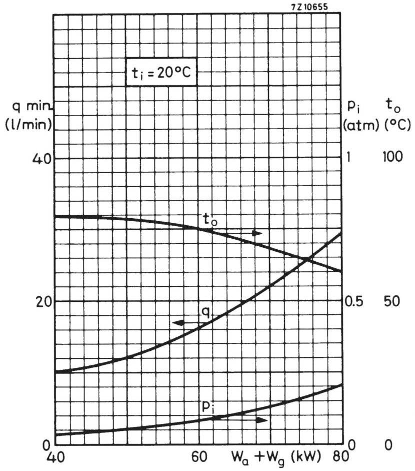
OPERATING CONDITIONS

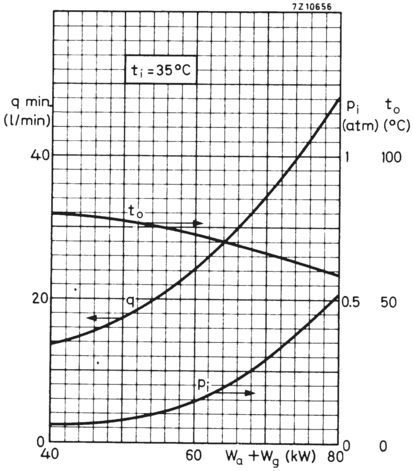
Frequency	f	30	30	MHz
Anode voltage	V_a	10.0	12.0	kV
Anode current	I_a	16.0	13.0	A
Anode input power	W_{ia}	160	156	kW
Anode dissipation	W_a	36.0	32.5	kW
Anode output power	W_o	124	123.5	kW
Anode efficiency	ηa	77.5	79.2	%
Grid resistor	R_g	200	330	Ω
Grid current, loaded	I_g	3.5	2.7	A
Grid dissipation	W_g	1.5	1.1	kW
Grid resistor dissipation	W_{R_g}	2.45	2.4	kW
Oscillator output power	W_{osc}	120	120	kW
Oscillator efficiency	ηosc	75	77	%
Feedback ratio	$V_{g\sim}/V_{a\sim}$	12.8	11.6	%

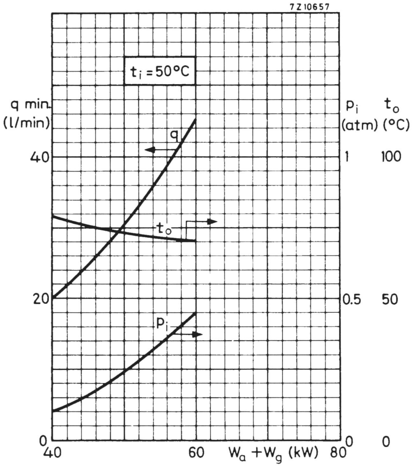
---

1) When the tubes are to be used at frequencies above 30 MHz the manufacturer should be consulted for more detailed information.


7Z07953
V_g (V)
600
500
400
300
200
100
0
-100
-200
-300
-400
-500
-600
$I_g = 20A$
15A
10A
5A
2A
1A
$I_a = 80A$
70A
60A
50A
40A
30A
20A
10A
5A
1A
0
2
4
6
8
10
12
14
16
V_a (kV)


7Z10655
t_i = 20°C
q min (l/min)
p_i (atm)
t_o (°C)
40
20
0
1
0.5
0
100
50
0
40
60
80
W_a + W_g (kW)
t_o
q
p_i


7Z10656
t_i = 35°C
q min (l/min)
p_i (atm)
t_o (°C)
40
20
0
1
0.5
0
100
50
0
40
60
80
W_a + W_g (kW)
t_o
q
p_i


7Z10657
t_i = 50°C
q min (l/min)
p_i (atm)
t_o (°C)
40
20
0
1
0.5
0
100
50
0
40
60
80
W_a + W_g (kW)
q
t_o
p_i

WATER COOLED
R.F. INDUSTRIAL POWER TRIODE

Water cooled triode in metal-ceramic construction with integral water cooler. The tube is intended for use as industrial oscillator.

QUICK REFERENCE DATA				
Frequency	f	up to	30	MHz
Anode voltage	V_a	=	14	kV
Anode current	I_a	=	23.5	A
Oscillator output power	W_{osc}	=	240	kW

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	12.6	V $^{+5\%}_{-10\%}$
Filament current	I_f	=	380	A
Peak filament starting current	I_{f_p}	=	max. 2000	A
Cold filament resistance	R_{f_o}	=	0.0036	Ω

CAPACITANCES

Anode to filament	C_{af}	=	3.0	pF
Grid to filament	C_{gf}	=	185	pF
Anode to grid	C_{ag}	=	60	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	14	kV
Anode current	I_a	=	10	A
Mutual conductance	S	=	190	mA/V
Amplification factor	μ	=	41	

TEMPERATURE LIMITS

Absolute max. envelope temperature	t_{env}	max.	240	°C
Recommended max. envelope temperature under continuously loaded conditions	t_{env}	max.	200	°C
Absolute max. water inlet temperature	t_i	max.	50	°C

COOLING CHARACTERISTICS (See also cooling curves)

$W_a + W_g$ (kW)	t_i (°C)	q_{min} (l/min)	p_i (atm)	t_o (°C)
120	20	60	0.7	50
	50	90	1.3	77
80	20	34	0.3	54
	50	54	0.55	72
40	20	15	0.07	60
	50	24	0.13	70

At frequencies below 4 MHz cooling of the metal-ceramic seals can be accomplished by a low-velocity air flow, or by watercooling of the filament connnectors. A water flow of approximately 0.5 l/min will be sufficient.
At frequencies above 4 MHz it is recommended to cool the seals by means of an air flow of approximately 4 m^3/min from a 50 mm diameter nozzle placed at a distance of 250 mm from the tube header.

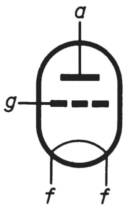
ACCESSORIES

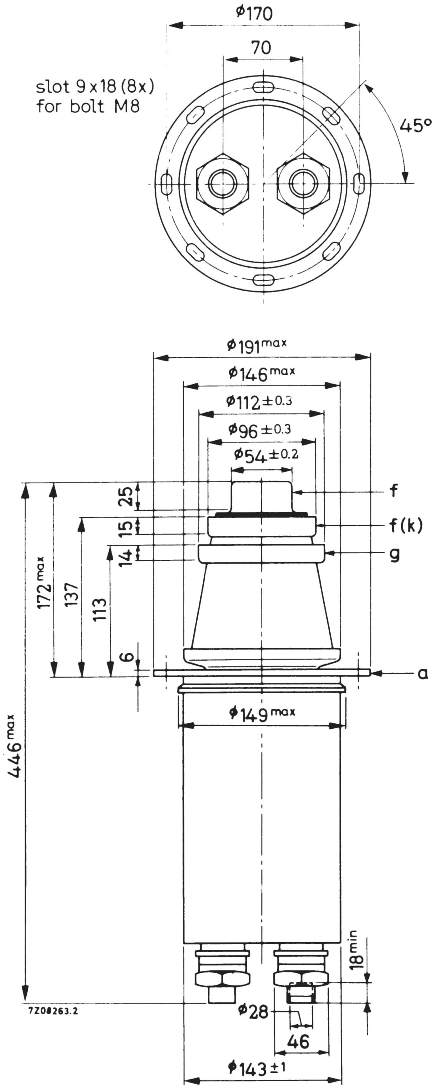
Grid connector	< 4 MHz	type	40694	net weight	270	g
Grid connector	> 4 MHz	type	40737	net weight	525	g
Filament connectors		type	40695	net weight	710	g
(both types required)		and type	40696	net weight	860	g
Filament cables		type	40716	net weight	975	g
(both types required)		and type	40717	net weight	980	g

MECHANICAL DATA

Net weigth approx. 15.6 kg

Dimensions in mm




ϕ170
70
slot 9 x 18 (8x)
for bolt M8
45°
ϕ191 max
ϕ146 max
ϕ112 ±0.3
ϕ96 ±0.3
ϕ54 ±0.2
25
15
14
6
172 max
137
113
446 max
f
f(k)
g
a
ϕ149 max
18 min
ϕ28
46
ϕ143 ±1
7Z08263.2

Mounting position: vertical with anode up or down

With anode up inlet and outlet connections should be interchanged.

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	100	MHz [1]
Anode voltage	V_a	max.	16.8	kV
Anode current	I_a	max.	25	A
Anode input power	W_{i_a}	max.	375	kW
Anode dissipation	W_a	max.	120	kW
Grid voltage	$-V_g$	max.	2.0	kV
Grid current, loaded	I_g	max.	7.0	A
unloaded	I_g	max.	8.5	A
Grid dissipation	W_g	max.	3.0	kW
Grid circuit resistance	R_g	max.	10	kΩ
Cathode current	I_k	max.	31	A

OPERATING CONDITIONS

Frequency	f	30	MHz
Anode voltage	V_a	14.0	kV
Anode current	I_a	23.5	A
Anode input power	W_{i_a}	329	kW
Anode dissipation	W_a	81.5	kW
Anode output power	W_o	247.5	kW
Anode efficiency	η	75.2	%
Grid resistor	R_g	135	Ω
Grid current, loaded	I_g	6.0	A
Grid dissipation	W_g	2.6	kW
Grid resistor dissipation	W_{R_g}	4.86	kW
Oscillator output power	W_{osc}	240	kW
Oscillator efficiency	η_{osc}	73.0	%
Feedback ratio	$V_{g\sim}/V_{a\sim}$	10.4	%

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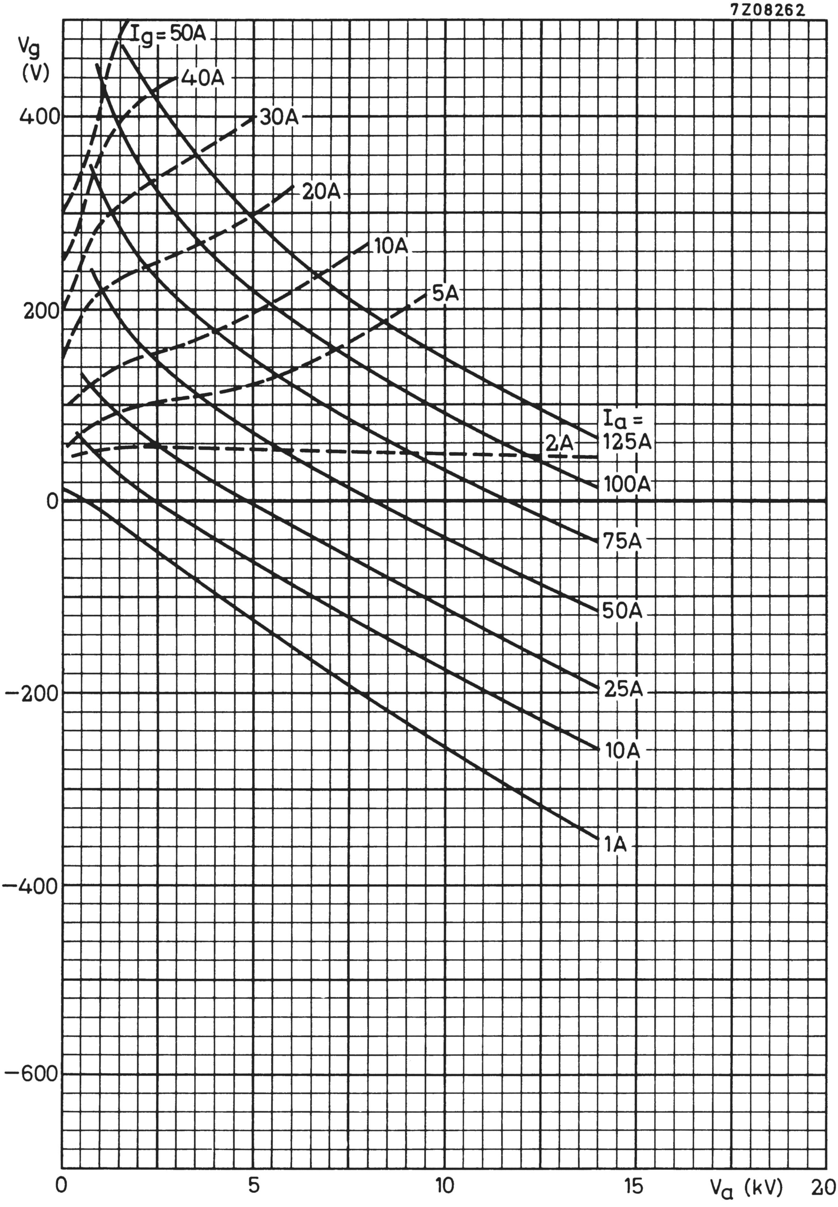
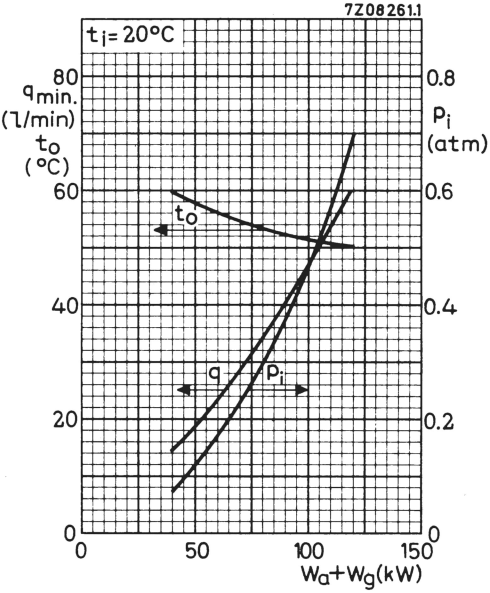
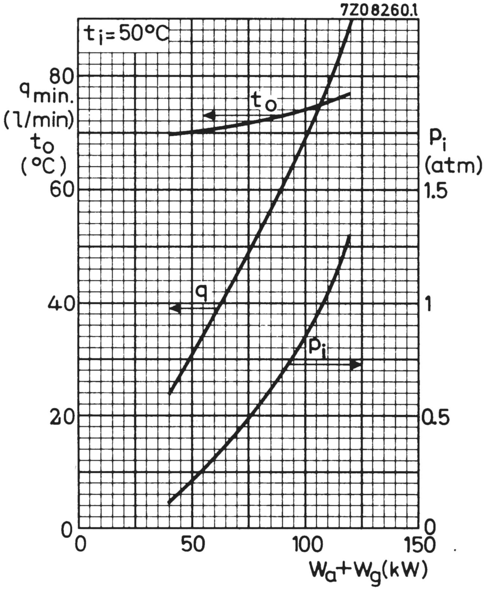
[1] When the tubes are to be used at frequencies above 30 MHz the manufacturer should be consulted for more detailed information.


7Z08262
Vg
(V)
400
200
0
−200
−400
−600
Ig = 50A
40A
30A
20A
10A
5A
2A
Ia =
125A
100A
75A
50A
25A
10A
1A
0
5
10
15
Va (kV)
20


7Z08261.1
$t_i = 20°C$
$q_{min.}$ (l/min)
t_o (°C)
p_i (atm)
0
20
40
60
80
0
0.2
0.4
0.6
0.8
t_o
q
p_i
0
50
100
150
$W_a + W_g$ (kW)


7Z08260.1
$t_i = 50°C$
$q_{min.}$ (l/min)
t_o (°C)
p_i (atm)
0
20
40
60
80
0
0.5
1
1.5
t_o
q
p_i
0
50
100
150
$W_a + W_g$ (kW)

VAPOUR COOLED R.F. INDUSTRIAL POWER TRIODE

Vapour cooled triode of metal-ceramic construction intended for use as industrial oscillator.

QUICK REFERENCE DATA			
Frequency	f	up to 30	MHz
Anode voltage	V_a	14	kV
Anode current	I_a	23.5	A
Oscillator output power	W_{osc}	240	kW

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f		12.6	V $^{+5\%}_{-10\%}$
Filament current	I_f		380	A
Peak filament starting current	I_{f_p}	max.	2000	A
Cold filament resistance	R_{f_o}		3.6	mΩ

CAPACITANCES

Anode to filament	C_{af}	3.0	pF
Grid to filament	C_{gf}	185	pF
Anode to grid	C_{ag}	60	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	14	kV
Anode current	I_a	10	A
Transconductance	S	190	mA/V
Amplification factor	μ	41	

TEMPERATURE LIMITS

Absolute max. envelope temperature	t_{env}	max.	240	°C
Recommended max. envelope temperature under continuous loaded conditions	t_{env}	max.	200	°C

At frequencies below 4 MHz cooling of the metal-ceramic seals can be accomplished by a low-velocity air flow, or by watercooling of the filament connectors. A water flow of approximately 0.5 l/min will be sufficient.
At frequencies above 4 MHz it is recommended to cool the seals by means of an air flow of approximately 4 m^3/min from a 50 mm diameter nozzle placed at a distance of 250 mm from the tube header.

COOLING CHARACTERISTICS

With integrated boiler/condensor type K733

$W_a + W_g$ (kW)	t_i (°C)	q_{min} (l/min)	t_o (°C)	P_i (atm)
120	20	59	50	0.84
80	20	29	61	0.20
	35	48	61	0.51
40	20	10	81	0.04
	35	13.5	81	0.06
	50	20	81	0.10

ACCESSORIES

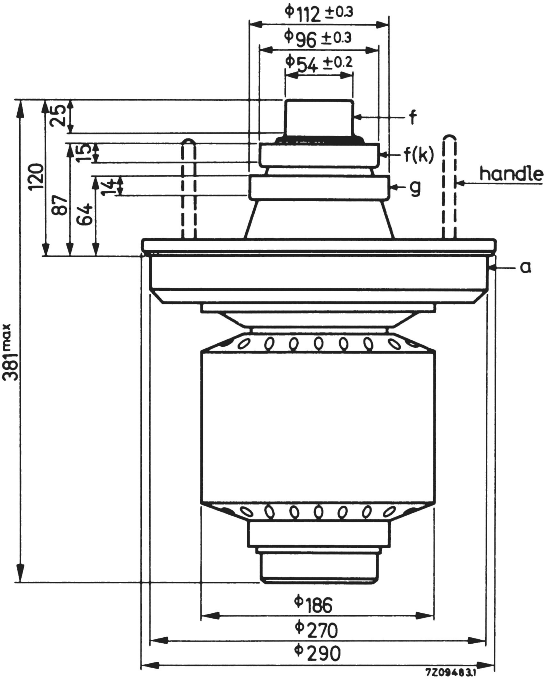
Grid connector	type 40737	net weight	525 g
Filament connectors (both types required)	type 40695	net weight	710 g
	and type 40696	net weight	860 g
Filament cable (both types required)	type 40716	net weight	975 g
	and type 40717	net weight	980 g
Boiler/condensor	type K733	net weight approx.	70 kg

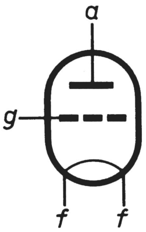
MECHANICAL DATA

Dimensions in mm

Net weight: 27 kg

Mounting position: vertical with anode down


ϕ112 ±0.3
ϕ96 ±0.3
ϕ54 ±0.2
25
15
14
120
87
64
381max
f
f(k)
g
handle
a
ϕ186
ϕ270
ϕ290
7Z09483.1



Note: The handles should be removed before switching on the tube.

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

LIMITING VALUES (Absolute max. rating system)

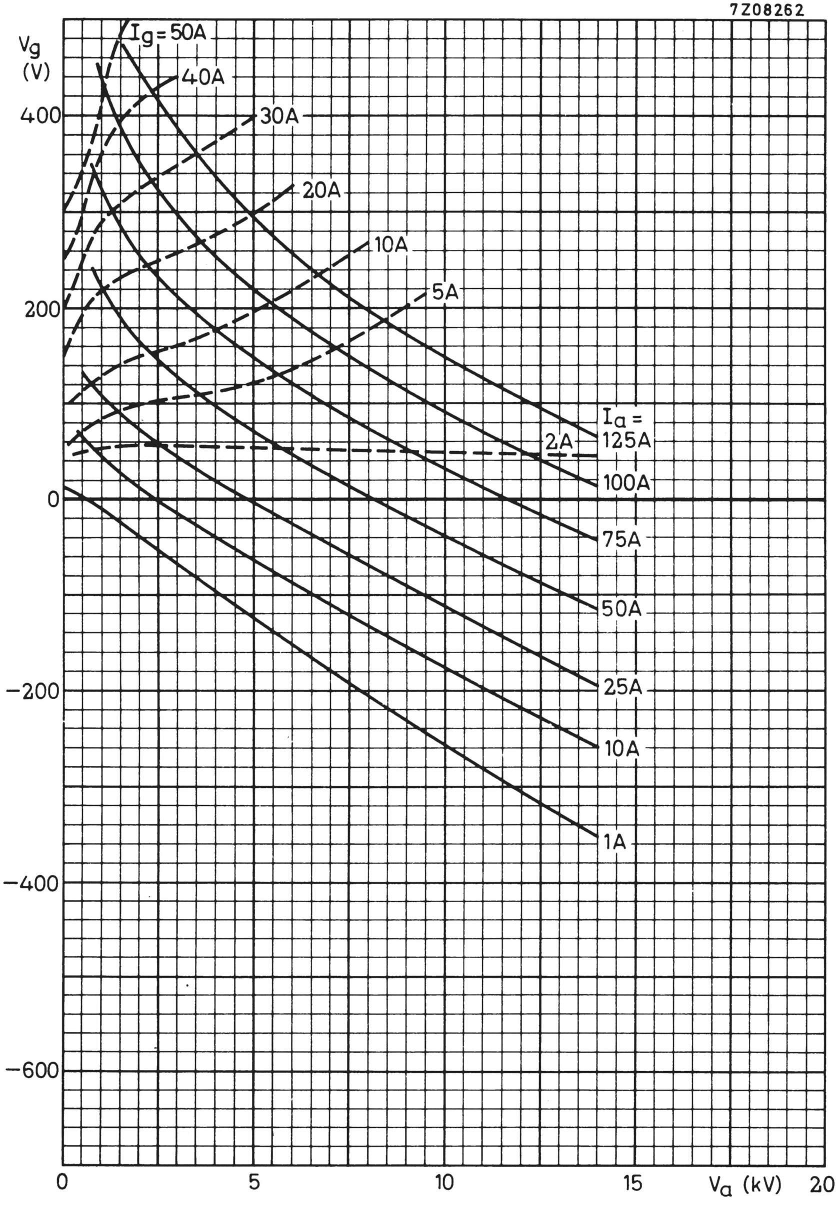
Frequency	f	up to	100	MHz
Anode voltage	V_a	max.	16.8	kV
Anode current	I_a	max.	25	A
Anode input power	W_{i_a}	max.	375	kW
Anode dissipation	W_a	max.	120	kW
Grid voltage	$-V_g$	max.	2000	V
Grid current, loaded	I_g	max.	7	A
unloaded	I_g	max.	8.5	A
Grid dissipation	W_g	max.	3.0	kW
Cathode current	I_k	max.	31	A
Grid circuit resistance	R_g	max.	10	kΩ

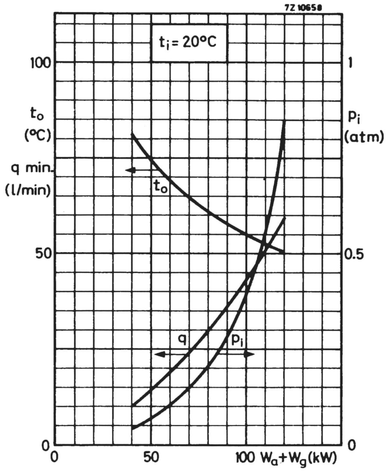
OPERATING CONDITIONS

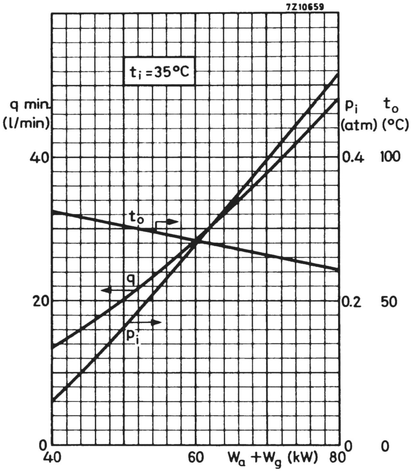
Frequency	f	30	MHz
Anode voltage	V_a	14	kV
Anode current	I_a	23.5	A
Anode input power	W_{i_a}	329	kW
Anode dissipation	W_a	81.5	kW
Anode output power	W_o	247.5	kW
Anode efficiency	η	75.2	%
Grid resistor	R_g	139	Ω
Grid current, loaded	I_g	6	A
Grid dissipation	W_g	2.6	kW
Grid resistor dissipation	W_{R_g}	4.86	kW
Oscillator output power	W_{osc}	240	kW
Oscillator efficiency	η_{osc}	73.0	%
Feedback ratio	V_g / V_a	10.4	%

---

1) When the tubes are to be used at frequencies above 30 MHz the manufacturer should be consulted for more detailed information.


7Z08262
V_g (V)
400
200
0
−200
−400
−600
I_g = 50A
40A
30A
20A
10A
5A
2A
I_a =
125A
100A
75A
50A
25A
10A
1A
0
5
10
15
V_a (kV)
20


7Z10658
t_i = 20°C
t_o
(°C)
q min.
(l/min)
p_i
(atm)
100
50
0
1
0.5
0
t_o
q
p_i
0
50
100 W_a+W_g(kW)


7Z10659
t_i = 35°C
q min.
(l/min)
p_i
(atm)
t_o
(°C)
40
20
0
0.4
0.2
0
100
50
0
t_o
q
p_i
40
60
W_a + W_g (kW)
80

AIR COOLED R.F. INDUSTRIAL POWER TRIODE

Forced air cooled triode of ceramic-metal construction, intended for use as industrial oscillator.

QUICK REFERENCE DATA				
Frequency	f	27.12	160	MHz
Anode voltage	V_a	5.0	4.5	kV
Anode current	I_a	750	700	mA
Oscillator output power	W_{osc}	2670	2220	W

HEATING : indirect; filament thoriated tungsten

Filament voltage ($f < 120$ MHz)	V_f	6.3	V $^{+5\%}_{-10\%}$
($f > 120$ MHz)	V_f	6.0	V $^{+5\%}_{-10\%}$
Filament current at $V_f = 6.3$ V	I_f	33	A

CAPACITANCES

Anode to filament	C_{af}	0.4	pF
Grid to filament	C_{gf}	17	pF
Anode to grid	C_{ag}	14	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	2.0	kV
Anode current	I_a	0.5	A
Transconductance	S	10	mA/V
Amplification factor	μ	20	

TEMPERATURE LIMITS (Absolute max.)

Absolute max. envelope temperature	t_{env}	max.	240	°C
Recommended max. envelope temperature under continuously loaded conditions	t_{env}	max.	200	°C

AIR COOLING CHARACTERISTICS

See cooling curves

A low velocity air flow directed to the filament and grid seals may be required.

ACCESSORIES

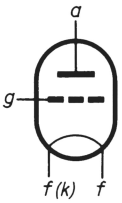
Filament connector	40688
Filament/cathode connector	40689
Grid connector (f < 30 MHz)	40686
(f > 30 MHz)	40687

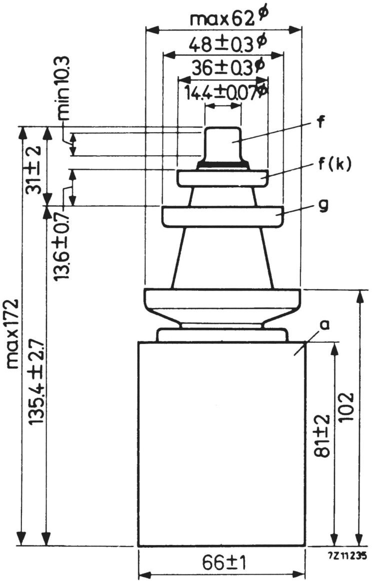
MECHANICAL DATA

Dimensions in mm

Mounting position: vertical with anode up or down.

Net weight: approx. 1.13 kg




max62ϕ
48±0.3ϕ
36±0.3ϕ
14.4±0.07ϕ
min10.3
f
f(k)
g
31±2
13.6±0.7
max172
135.4±2.7
a
81±2
102
66±1
7Z11235

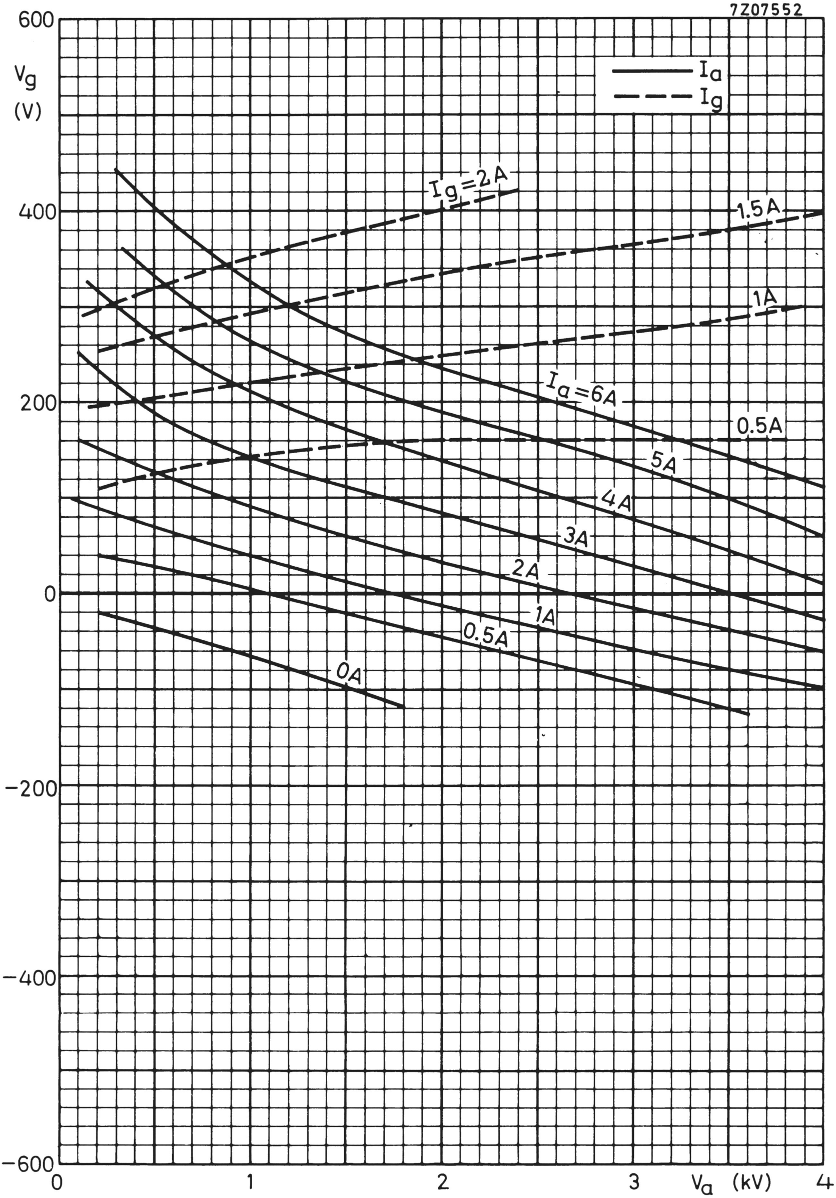
R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

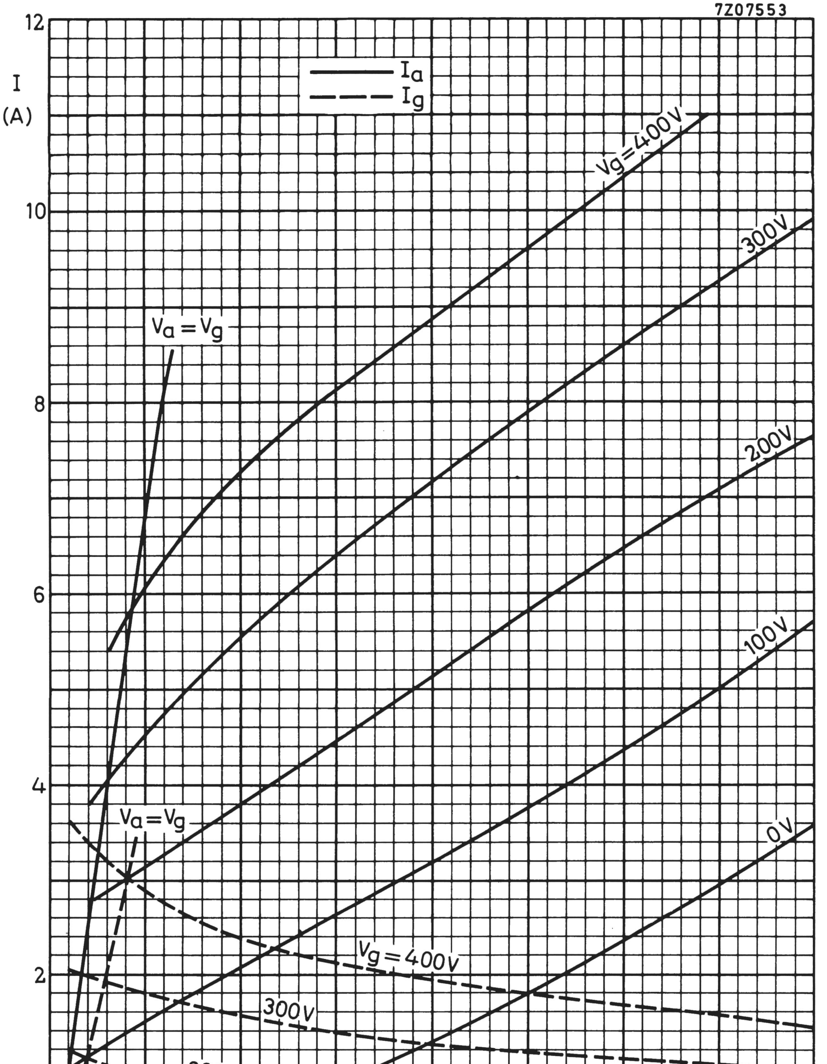
LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	250	MHz
Anode voltage	V_a	max.	5.5	kV
Anode current	I_a	max.	1.1	A
Anode input power	W_{ia}	max.	6.0	kW
Anode dissipation	W_a	max.	1.5	kW
Grid voltage	$-V_g$	max.	1.0	kV
Grid current, loaded	I_g	max.	280	mA
unloaded	I_g	max.	400	mA
Grid dissipation	W_g	max.	150	W
Grid circuit resistance	R_g	max.	20	kΩ
Cathode current	I_k	max.	1.4	A

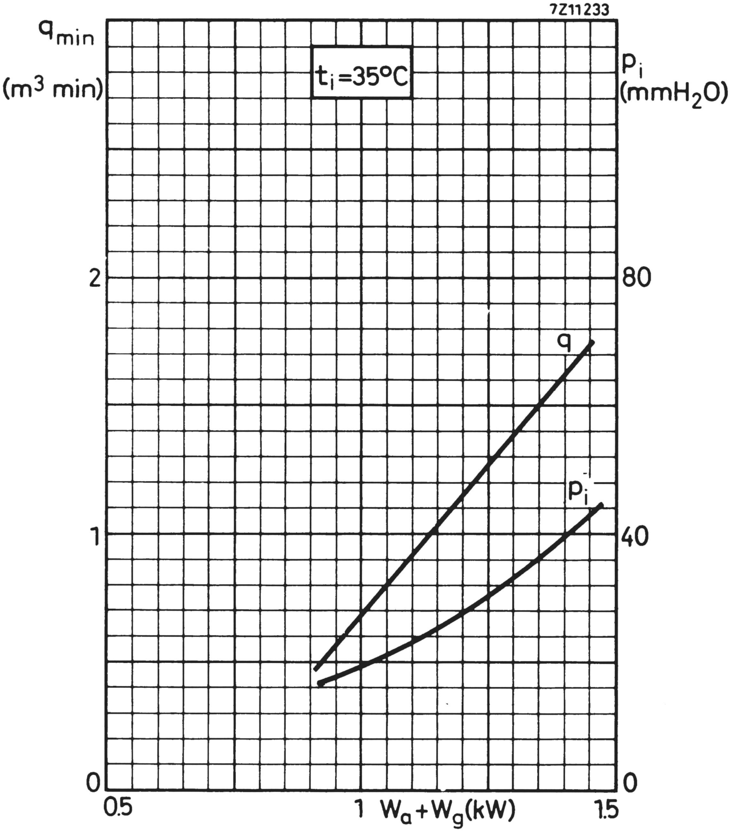
OPERATING CONDITIONS

Frequency	f	160	27.12	MHz
Filament voltage	V_f	6.0	6.3	V
Anode voltage	V_a	4.5	5.0	kV
Anode current	I_a	700	750	mA
Anode input power	W_{ia}	3150	3750	W
Anode dissipation	W_a	750	830	W
Anode output power	W_o	2400	2900	W
Anode efficiency	η	76	78	%
Grid resistor	R_g	2.2	2.2	kΩ
Grid current, loaded	I_g	225	235	mA
Grid dissipation	W_g	70	80	W
Grid resistor dissipation	W_{R_g}	111	121	W
Oscillator output power	W_{osc}	2220	2670	W
Oscillator efficiency	η_{osc}	71	71	%
Feedback ratio	$V_{g\sim}/V_{a\sim}$	17	17	%

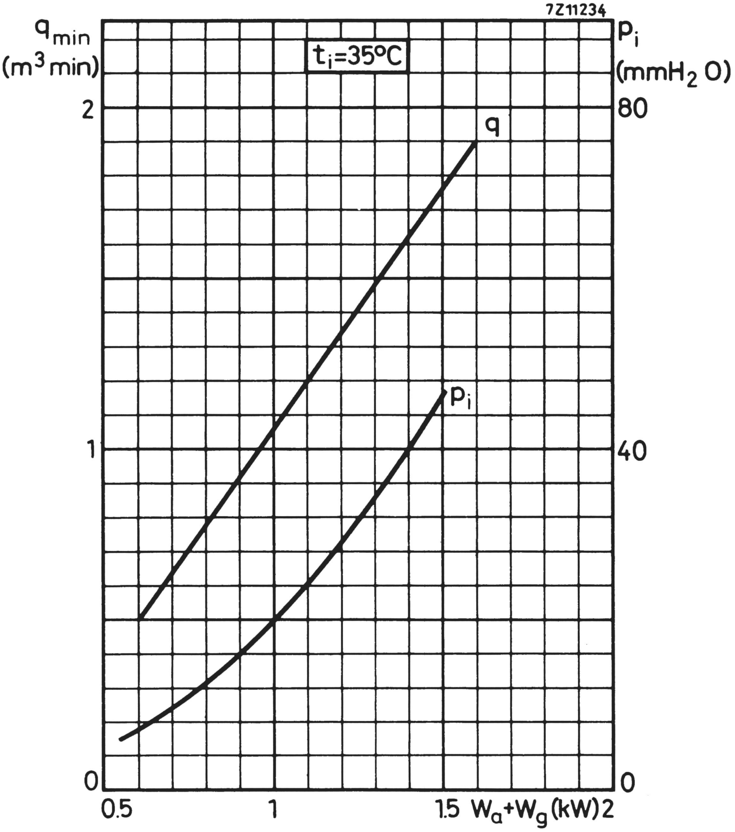

7Z07552
600
400
200
0
−200
−400
−600
V_g
(V)
I_a
I_g
I_g=2A
1.5A
1A
0.5A
I_a=6A
5A
4A
3A
2A
1A
0.5A
0A
0
1
2
3
V_a (kV)
4


7Z07553
I
(A)
12
10
8
6
4
2
0
Ia
Ig
Vg=400V
300V
200V
100V
0V
−100V
Va=Vg
Va=Vg
Vg=400V
300V
200V
100V
0
1
2
3
4
Va (kV)

Air flow to header



Air flow from header



WATER COOLED MAGNETICALLY BEAMED TRIODE

Rugged water cooled magnetically focused power triode with integral water jacket intended for use as industrial oscillator for frequencies up to 5 MHz.

QUICK REFERENCE DATA			
Frequency	f	5	MHz
Anode voltage	V_a	4.5	kV
Anode current	I_a	720	mA
Oscillator output power	W_{osc}	3094	W

HEATING: indirect; nickel-oxide cathode, dispenser type

Heater voltage	V_f		5	V ±10%
Heater current	I_f		6.1	A
Waiting time	T_w	min.	2	min

CAPACITANCES

Anode to cathode	C_{ak}	0.3	pF
Grid to cathode	C_{gk}	9.8	pF
Anode to grid	C_{ag}	11.5	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a		3000	V
Anode current	I_a		500	mA
Transconductance	S		4	mA/V
Amplification factor	μ		25	
Magnetic flux density	B	min. (= 1150	115	mT Gs)

Care should be taken that the magnetic flux density is not influenced by external magnetic materials.

Data based on pre-production tubes.

TEMPERATURE LIMITS

Absolute max. seal temperature	t_s	max.	200	°C

COOLING

W_a (kW)	t_i (°C)	$q_{min.}$ (l/min)	p_i (atm)
2	20	3.8	0.31
	50	5.7	0.62

The waterflow must be maintained for at least 1 minute after anode power is removed.

Additional air cooling of the seals may be necessary to keep the temperature below the limiting value.

The direction of the water flow must be such that the inflow is below the outlet for either of the two vertical mounting positions.

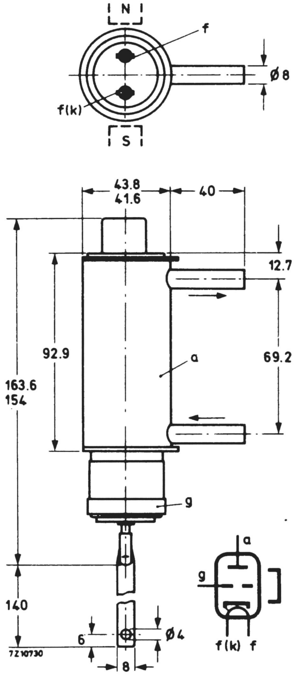
ACCESSORIES

Magnet assembly (magnetic nest)	type 40765	net weight 2.3 kg
Grid connector	40766	

MECHANICAL DATA

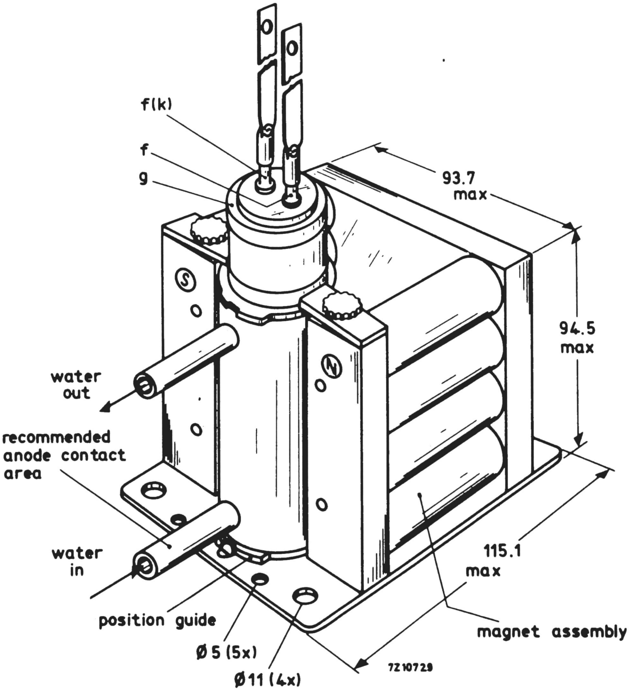
Dimensions in mm

Net weight: approx. 0.45 kg



Mounting position: vertical

Due to the very rugged construction of this type, generally it can be shipped mounted in the equipment


f(k)
f
g
93.7 max
94.5 max
water out
recommended anode contact area
water in
115.1 max
position guide
Ø 5 (5x)
Ø 11 (4x)
magnet assembly
7Z10729

Tube mounted in magnet assembly

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

Anode voltage single phase, full-wave rectified, unfiltered.

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	5	MHz
Anode voltage	V_a	max.	4500	V 1)
Anode current	I_a	max.	725	mA 1)
Anode input power	W_{i_a}	max.	4	kW
Anode dissipation	W_a	max.	2	kW
Grid voltage	V_g	max.	2400	V
Grid current	I_g	see note 2		
Grid dissipation	W_g	max.	25	W
Cathode current	I_k	max.	730	mA 1)
Grid circuit resistor	R_g	max.	88	kΩ

OPERATING CONDITIONS

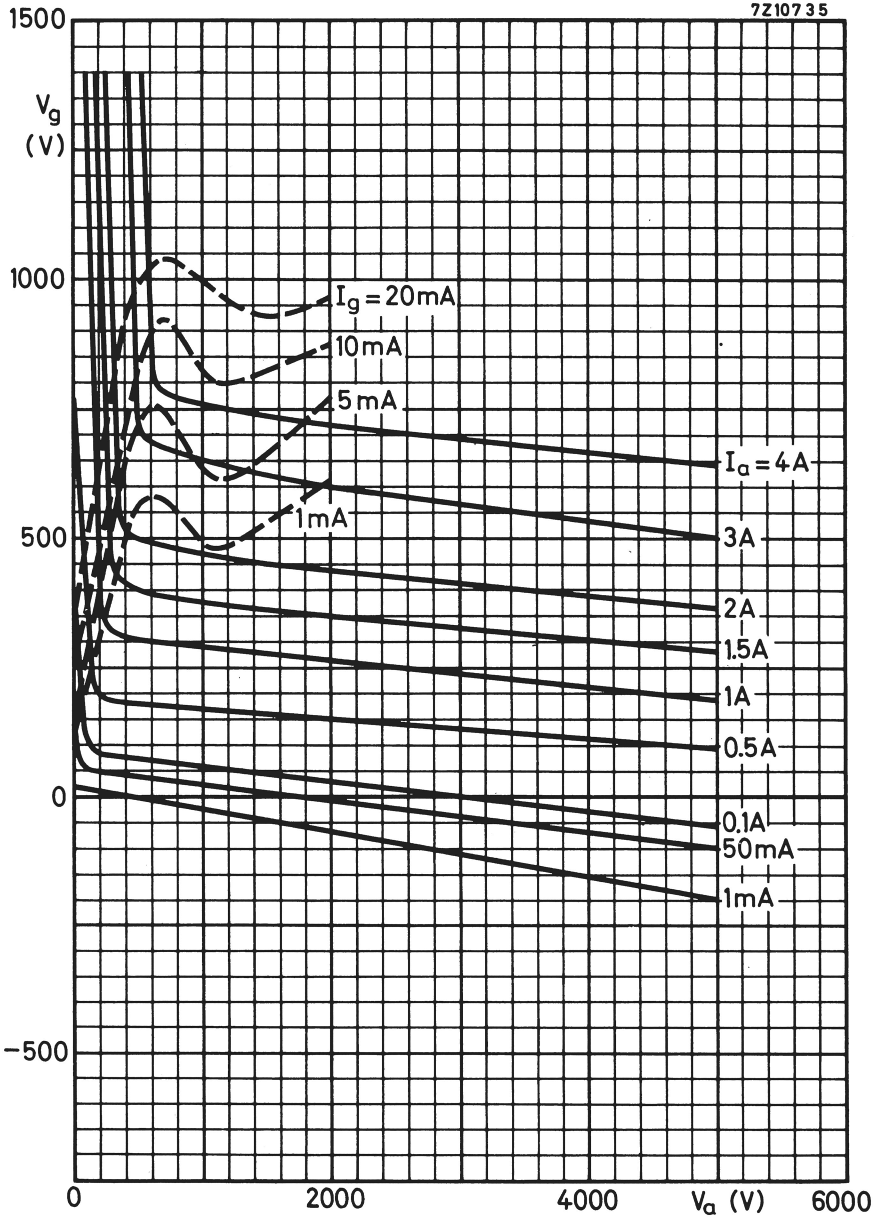
Frequency	f	5	MHz
Transformer voltage	V_{tr}	5000	V_{rms}
Anode voltage	V_a	4500	V 1)
Anode current	I_a	720	mA 1)
Anode input power	W_{i_a}	4000	W
Anode dissipation	W_a	900	W
Anode output power	W_o	3100	W
Anode efficiency	η	78	%
Grid resistor	R_g	80	kΩ
Grid voltage	V_g	-360	V 3)
Grid current, loaded	I_g	4.5	mA
unloaded	I_g	9	mA
Grid dissipation	W_g	4.4	W
Grid resistor dissipation	W_{R_g}	1.6	W
Oscillator output power	W_{osc}	3094	W
Oscillator efficiency	η_{osc}	77.4	%
Feedback ratio	$V_{g\sim}/V_{a\sim}$	33	%

---

1) Mean value.

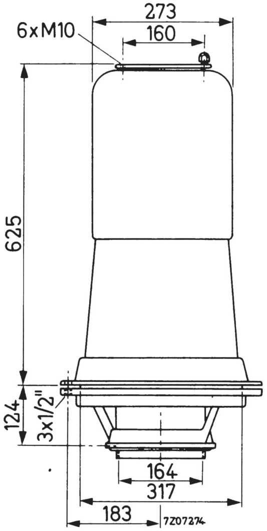
2) Limited by W_g max. and I_k max.

3) Max. −565 V.

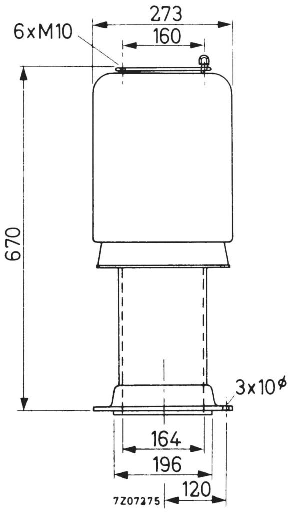

7Z10735
1500
1000
500
0
−500
V_g (V)
0
2000
4000
V_a (V)
6000
I_g = 20mA
10mA
5mA
1mA
I_a = 4A
3A
2A
1.5A
1A
0.5A
0.1A
50mA
1mA

Associated accessories

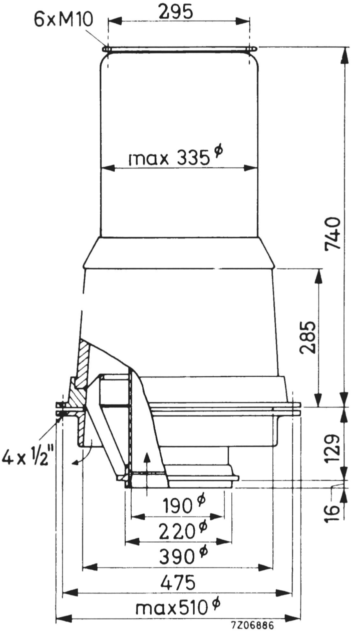
COOLER HOUSING FOR AIR COOLING


273
160
6xM10
625
124
3x1/2"
164
317
183
7Z07274

COOLER HOUSING FOR AIR COOLING

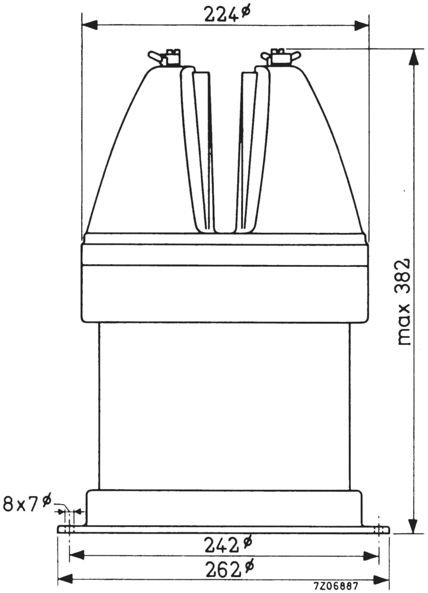

273
160
6xM10
670
3x10⌀
164
196
120
7Z07275

COOLER HOUSING FOR AIR COOLING


6xM10
295
max 335ϕ
740
285
129
16
4 x ½"
190ϕ
220ϕ
390ϕ
475
max510ϕ
7Z06886

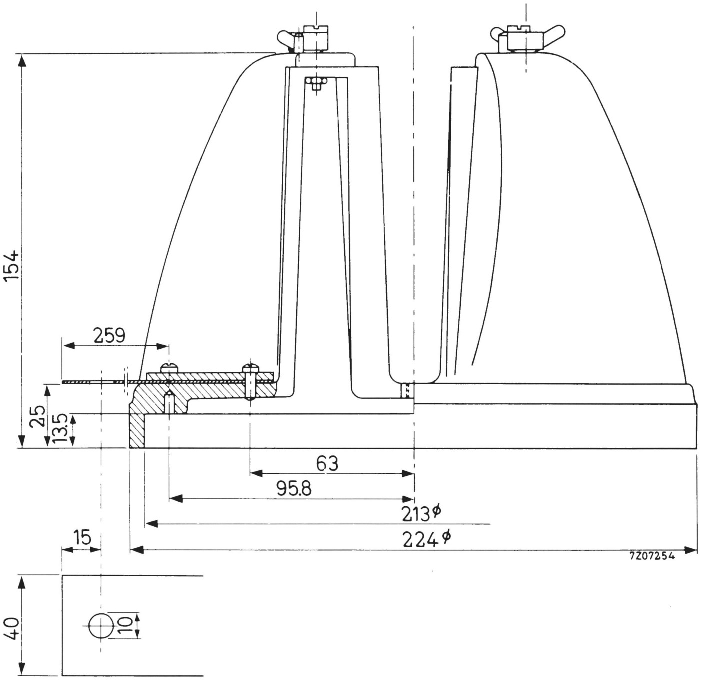
Net weight	72 kg

COOLER HOUSING FOR AIR COOLING

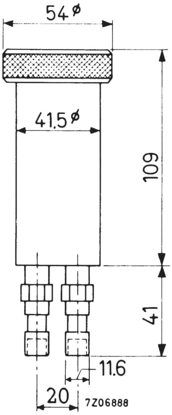

224ø
max 382
8x7ø
242ø
262ø
7Z06887

Net weight 7.4 kg

AIR DISTRIBUTOR
UPPER PART OF K508

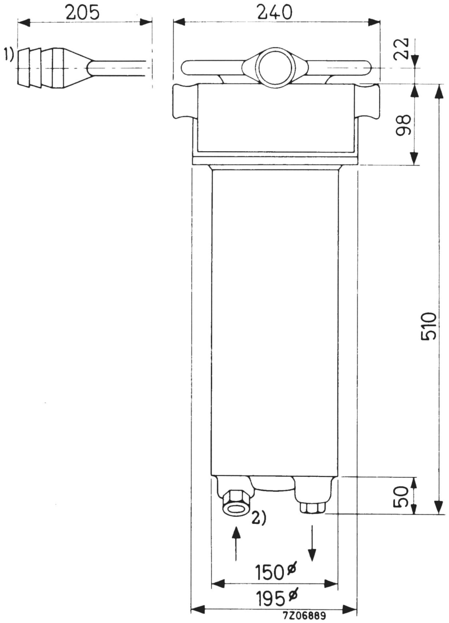

154
259
25
13.5
63
95.8
213⌀
224⌀
15
40
10
7Z07254

WATER JACKET


54 ø
41.5 ø
109
41
11.6
20
7Z06888

Net weight	0.52 kg

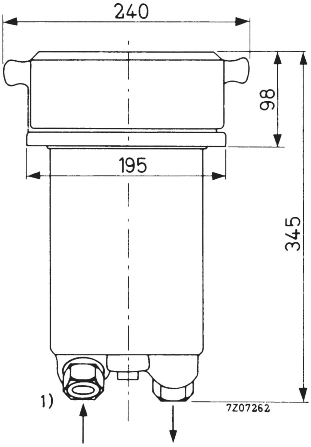
WATER JACKET


205
240
22
98
510
50
1)
2)
150ø
195ø
7Z06889

1) Use connecting hose with an inner diameter of $1^3/4$"
2) Coupling for metal tubing with an outer diameter of 28mm

Net weight 20.5 kg

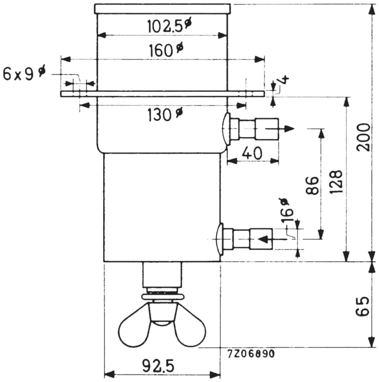
WATER JACKET


240
98
195
345
1)
7Z07262

[1] coupling for metal tubing with an outer diameter of 28mm

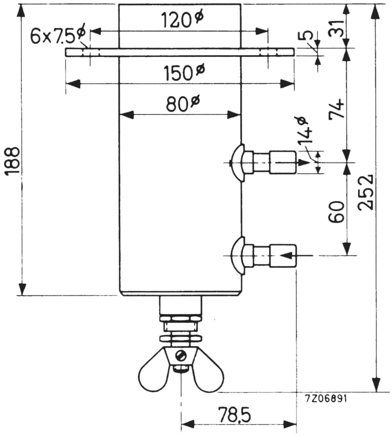
Net weight 16.7 kg

WATER JACKET


102,5ø
160ø
6x9ø
4
130ø
40
200
128
86
16ø
65
7Z06890
92,5

Net weight 2.1 kg

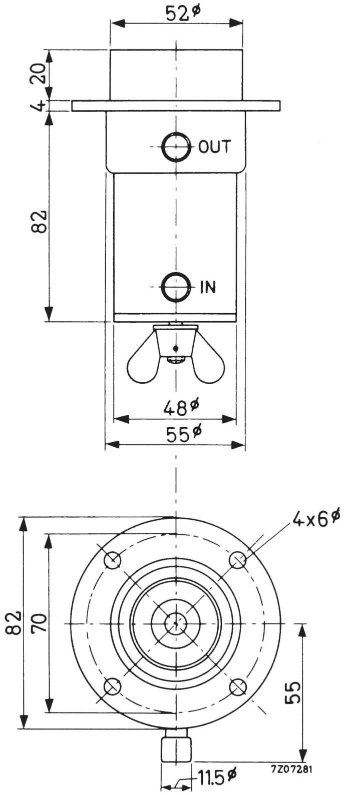
WATER JACKET



120ø
6x7,5ø
150ø
80ø
5
31
74
14ø
188
60
252
7Z06891
78,5

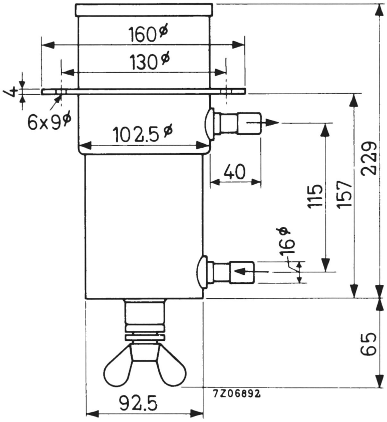
Net weight 2.2 kg

WATER JACKET


52ø
20
4
OUT
82
IN
48ø
55ø
4x6ø
82
70
55
11.5ø
7Z07281

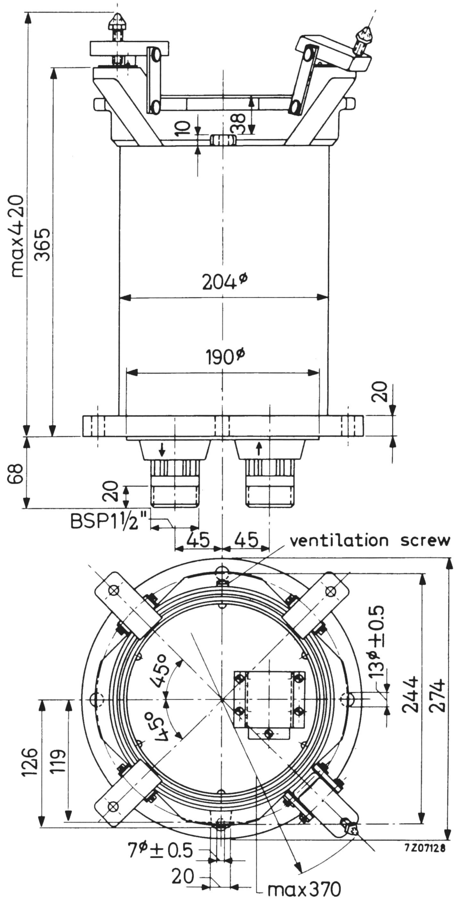
Net weight 0.76 kg

WATER JACKET


160⌀
130⌀
4
6x9⌀
102.5⌀
40
115
157
229
16⌀
65
92.5
7Z06892

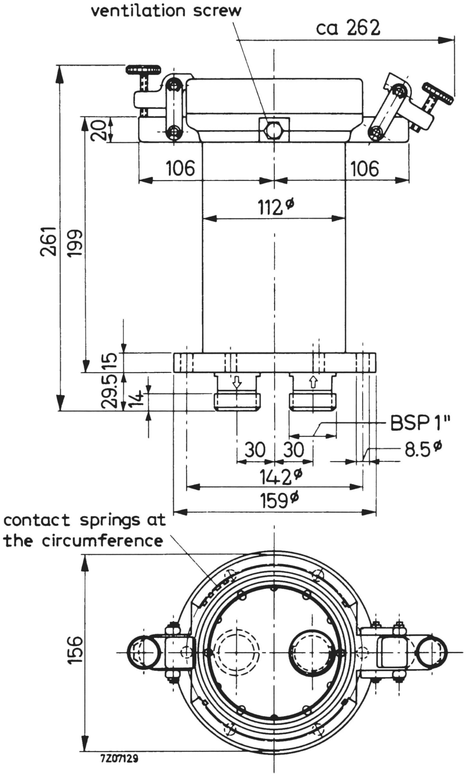
Net weight 2.7 kg

WATER JACKET


max420
365
10
38
204⌀
190⌀
20
68
20
BSP1½"
45
45
ventilation screw
13⌀±0.5
244
274
45°
45°
126
119
7⌀±0.5
20
max370
7Z07128

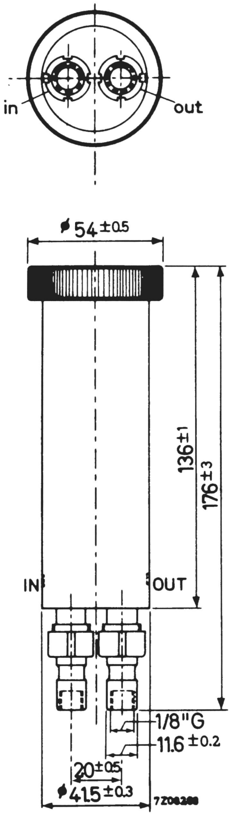
Water pressure	max.	5	ATO
Net weight		30.5	kg

WATER JACKET

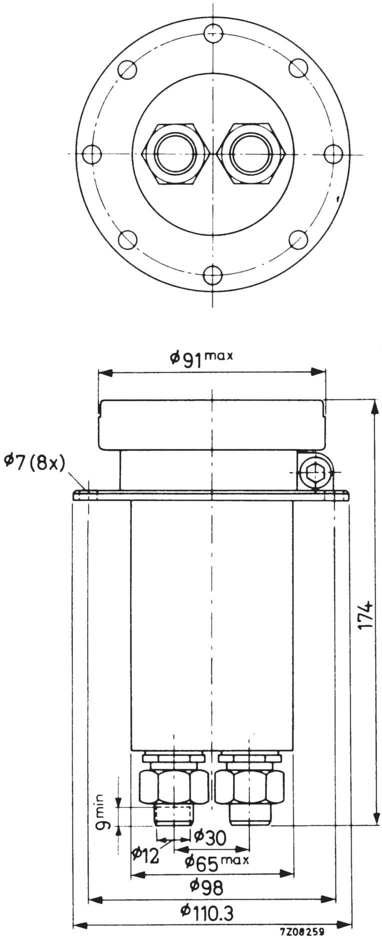

ventilation screw
ca 262
261
199
20
106
106
112ø
15
29.5
14
BSP 1"
8.5ø
30
30
142ø
159ø
contact springs at the circumference
156
7Z07129

Water pressure	max. 5	ATO
Net weight	5	kg

WATER JACKET

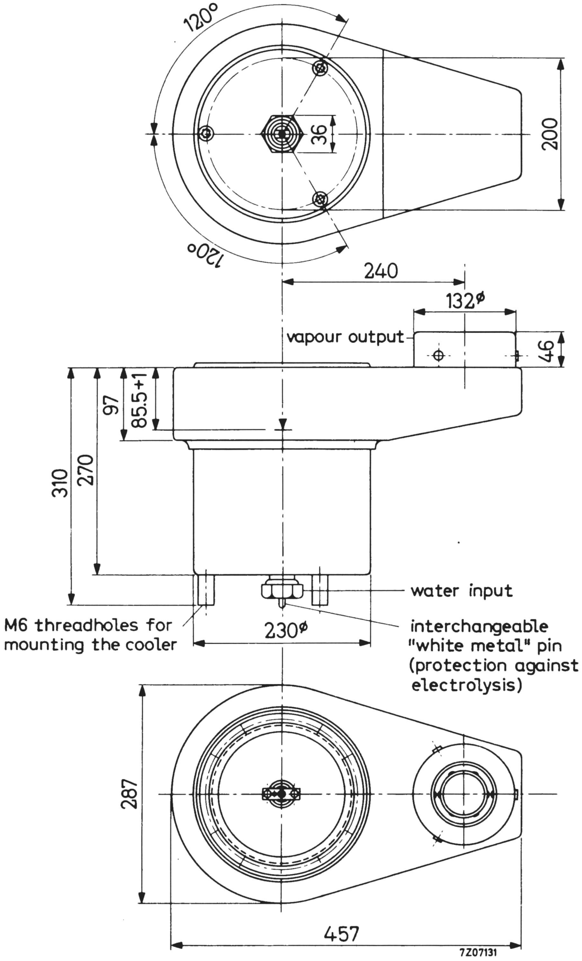

in
out
ϕ54 ±0.5
136±1
176±3
IN
OUT
1/8"G
11.6 ±0.2
20±0.5
ϕ41.5±0.3
7Z08288

WATER JACKET


ø91 max
ø7 (8x)
174
9 min
ø12
ø30
ø65 max
ø98
ø110.3
7Z08259

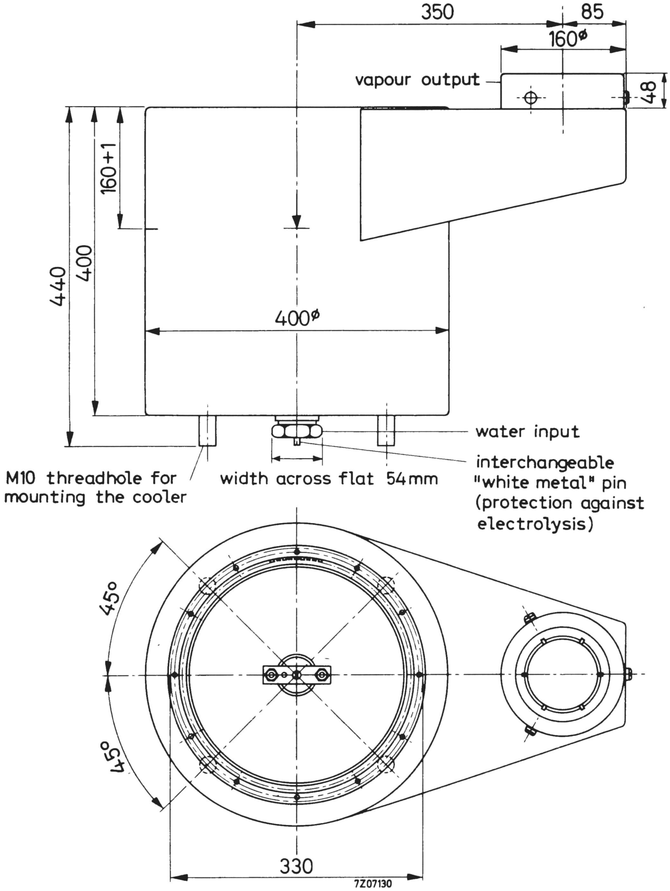
Net weight 2 kg

VAPOUR JACKET


120°
120°
36
200
240
132ø
vapour output
46
310
270
97
85.5+1
water input
M6 threadholes for mounting the cooler
230ø
interchangeable "white metal" pin (protection against electrolysis)
287
457
7Z07131

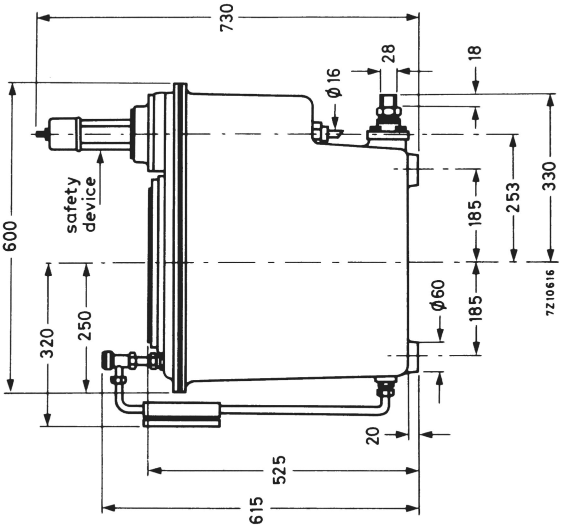
Net weight 8 kg

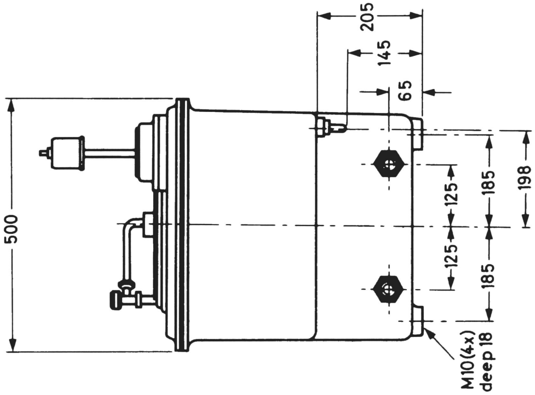
VAPOUR JACKET


350
85
160ø
vapour output
48
160+1
440
400
400ø
water input
interchangeable "white metal" pin (protection against electrolysis)
M10 threadhole for mounting the cooler
width across flat 54mm
45°
45°
330
7Z07130

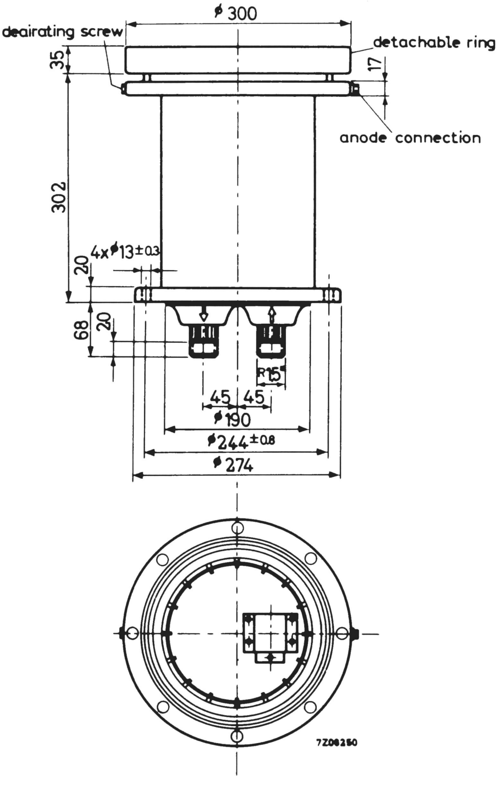
Net weight 22 kg

BOILER—CONDENSOR


730
28
18
Ø16
safety device
600
320
250
185
253
330
185
Ø60
7Z10616
20
525
615


205
145
65
500
125
125
185
185
198
M10(4x) deep 18

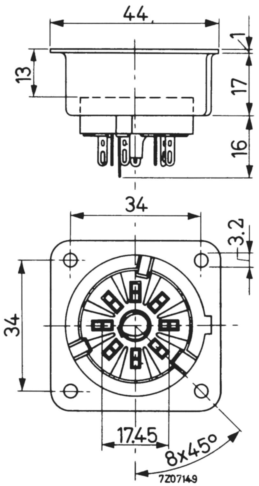
WATER JACKET



ϕ 300
deairating screw
detachable ring
35
17
anode connection
302
4xϕ13±0.3
20
68
20
R15
45
45
ϕ190
ϕ244±0.8
ϕ274
7Z08250

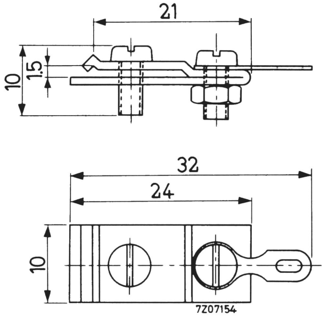
TUBE SOCKET

WITH 8 SPRING CONTACTS AND CENTRAL LOCATING
AND LOCKING DEVICE


44
1
13
17
16
34
3.2
34
17.45
8x45°
7Z07149

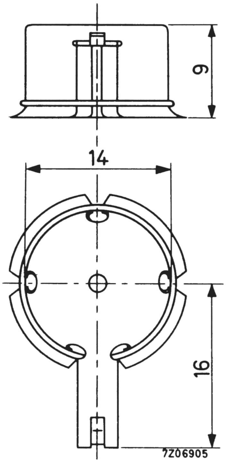
Chassis hole 42 mm

ANODE CONNECTOR


21
10
1.5
32
24
10
7Z07154

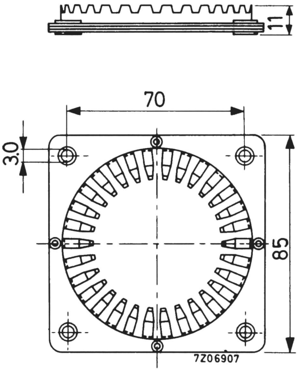
TOP CAP CONNECTOR

FOR TOP CAPS WITH 14.38 mm Ø (IEC 67-III-1b, type 3).


9
14
16
7Z06905

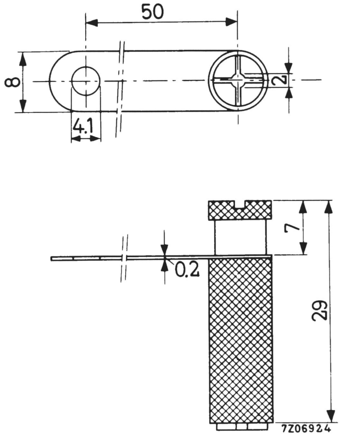
Material: brass, nickel plated

GRID CONNECTOR


11
70
3.0
85
7Z06907

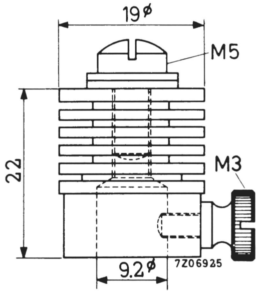
Material: brass, silver plated

ANODE CONNECTOR


50
8
2
4.1
7
0.2
29
7Z06924

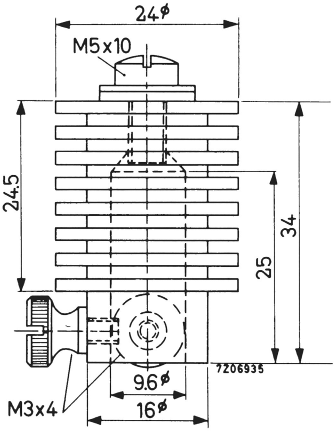
Material: brass, silver plated

ANODE CONNECTOR


19ø
M5
M3
22
9.2ø
7Z06925

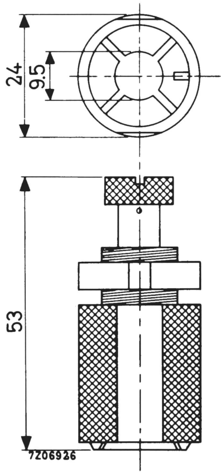
Material: brass, nickel plated

ANODE CONNECTOR


24ø
M5x10
24.5
34
25
7Z06935
9.6ø
16ø
M3x4

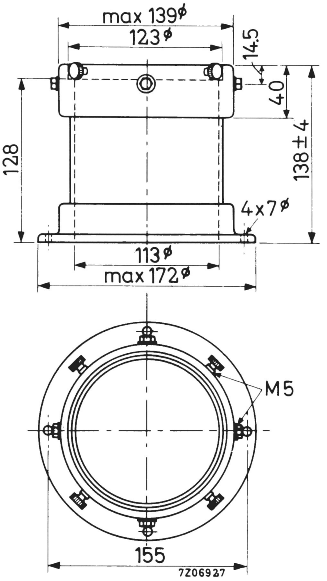
Material: brass, nickel plated

FILAMENT CONNECTOR


24
9.5
53
7Z06936

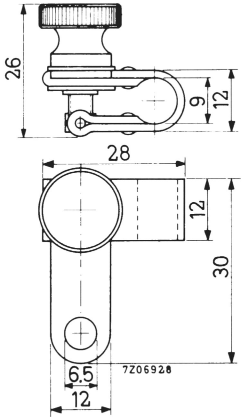
Material: brass, silver plated

INSULATING PEDESTAL

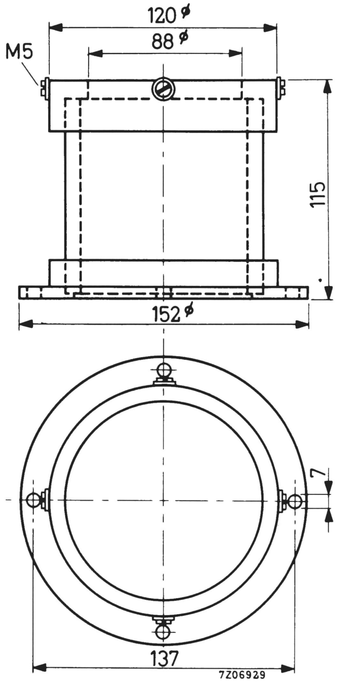

max 139⌀
123⌀
14.5
40
138 ± 4
128
4×7⌀
113⌀
max 172⌀
M5
155
7Z06927

Material: ceramic
Net weight: 2.1 kg

FILAMENT CONNECTOR

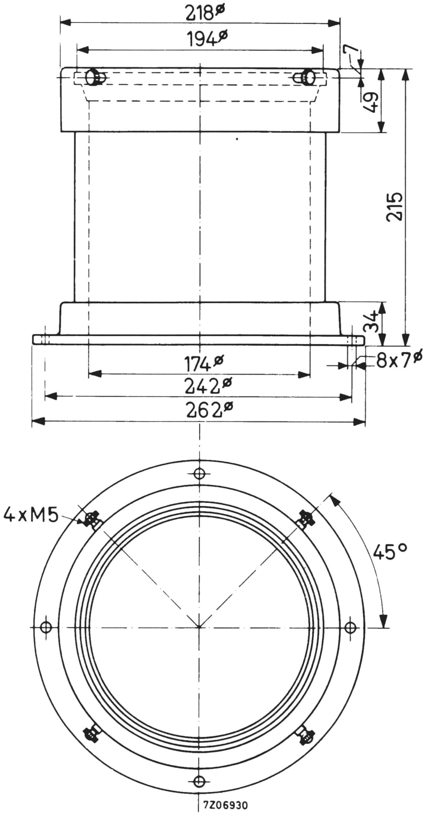

26
9
12
28
12
30
6.5
12
7Z06928

INSULATING PEDESTAL


120 ø
88 ø
M5
115
152 ø
7
137
7Z06929

Material: ceramic
Net weight: 1.6 kg

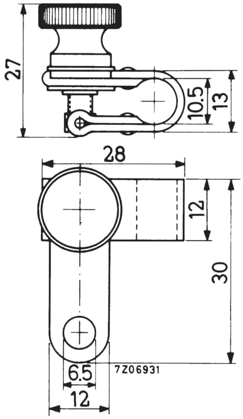
INSULATING PEDESTAL



218ø
194ø
7
49
215
34
8x7ø
174ø
242ø
262ø
4xM5
45°
7Z06930

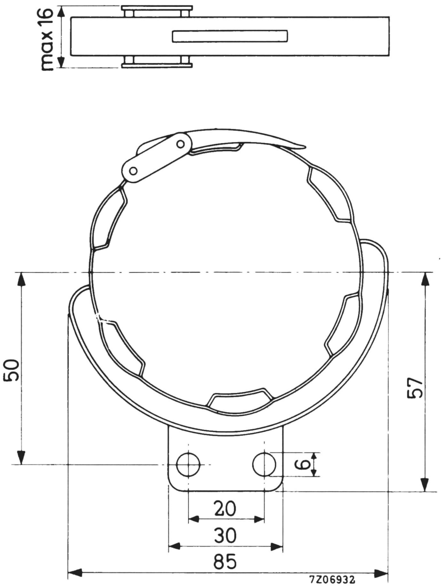
Material: ceramic

FILAMENT CONNECTOR


27
10.5
13
28
12
30
6.5
12
7Z06931

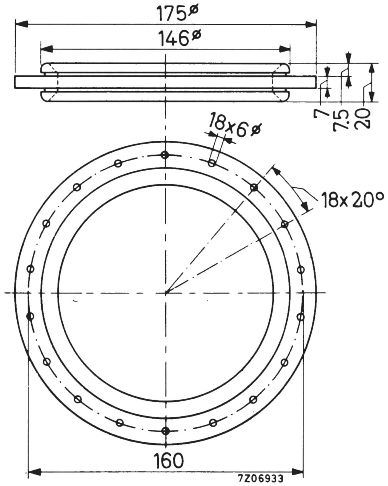
Material: brass, silver plated

GRID CONNECTOR


max 16
50
57
6
20
30
85
7Z06932

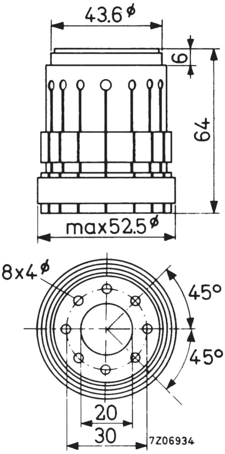
Material: brass, silver plated

GRID AND ANODE CONNECTOR


175ø
146ø
7
7.5
20
18x6ø
18x20°
160
7Z06933

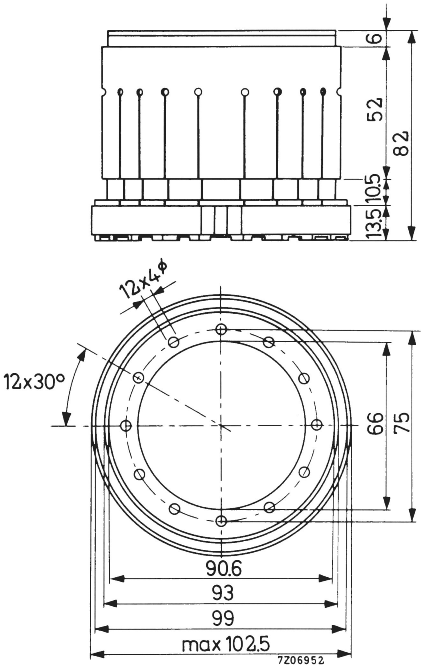
Material: brass, silver plated

FILAMENT CONNECTOR


43.6 ø
6
64
max52.5 ø
8x4 ø
45°
45°
20
30
7Z06934

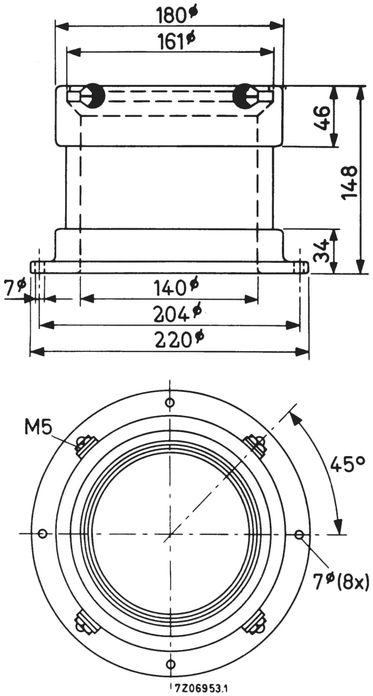
Material: brass, silver plated

FILAMENT CONNECTOR


6
52
82
10.5
13.5
12x4ϕ
12x30°
66
75
90.6
93
99
max 102.5
7Z06952

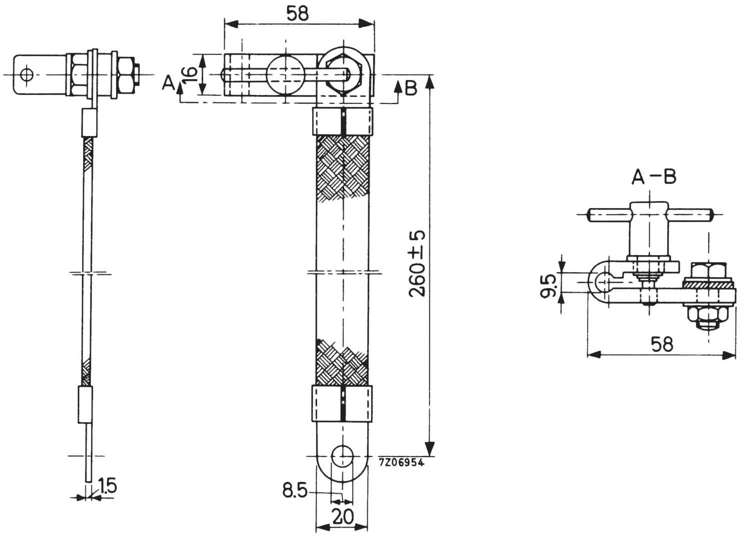
Material: brass, silver plated

INSULATING PEDESTAL


180⌀
161⌀
46
148
34
7⌀
140⌀
204⌀
220⌀
M5
45°
7⌀(8x)
7Z06953.1

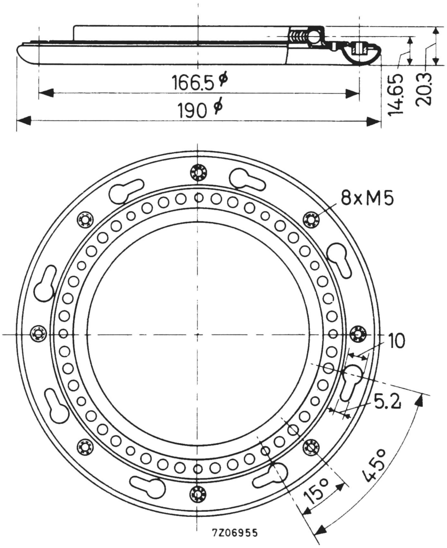
Material: ceramic
Net weight: 4.25 kg

FILAMENT CONNECTOR WITH CABLE


58
16
A
B
260±5
7Z06954
8.5
20
1.5
A–B
9.5
58

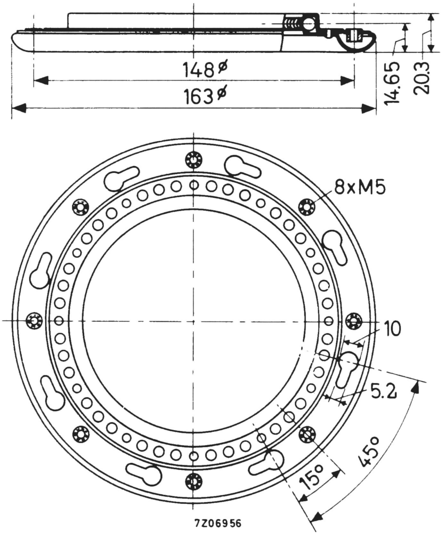
Material:	cable	- twined copper
	connector	- brass, nickel plated

GRID CONNECTOR


166.5 ϕ
190 ϕ
14.65
20.3
8xM5
10
5.2
15°
45°
7Z06955

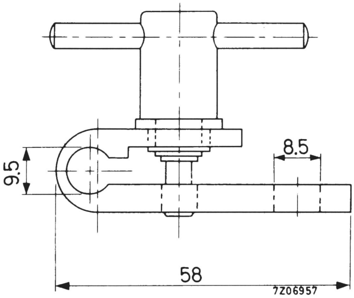
Material: brass, silver plated

GRID CONNECTOR


148ø
163ø
14.65
20.3
8xM5
10
5.2
45°
15°
7Z06956

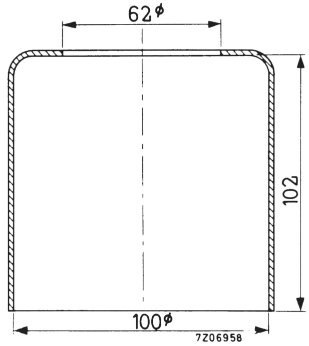
Material: brass, silver plated

ANODE CONNECTOR


8.5
9.5
58
7Z06957

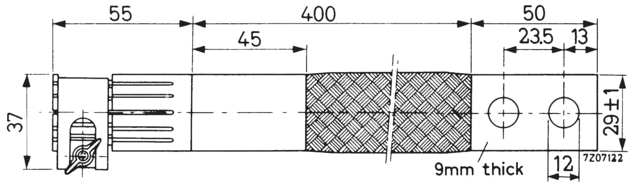
Material: brass, nickel plated

CHIMNEY

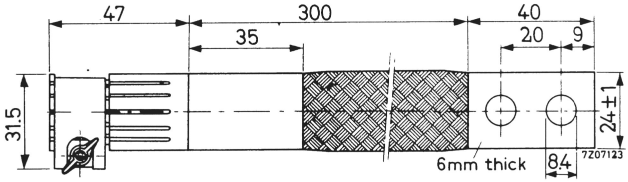

62ϕ
102
100ϕ
7Z06958

Material: glass

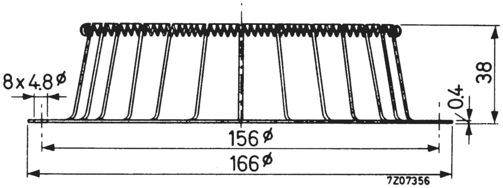
FILAMENT CONNECTOR WITH CABLE


55
400
50
45
23.5
13
37
29±1
9mm thick
12
7Z07122

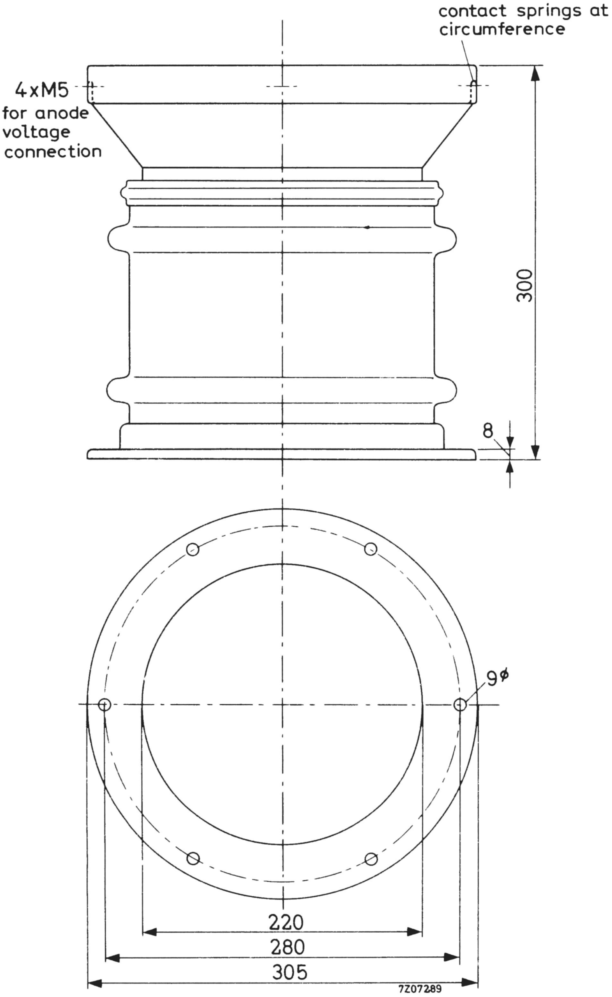
FILAMENT CONNECTOR WITH CABLE


47
300
40
35
20
9
31.5
24±1
6mm thick
8.4
7Z07123

GRID CONNECTOR

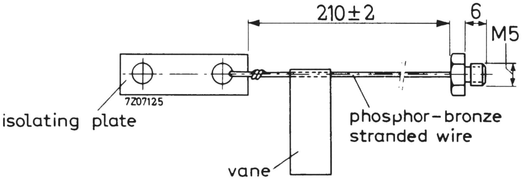

8x4.8⌀
38
0.4
156⌀
166⌀
7Z07356

INSULATING PEDESTAL

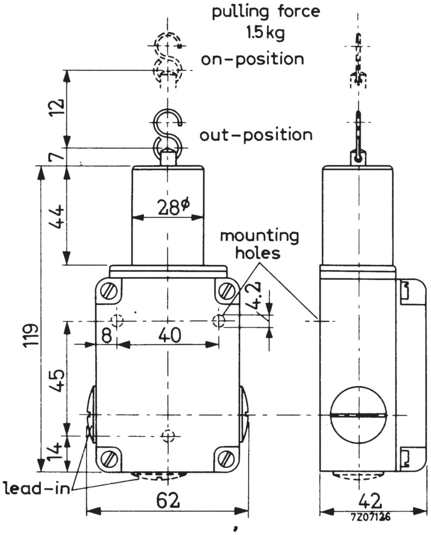

contact springs at circumference
4xM5 for anode voltage connection
300
8
9ø
220
280
305
7Z07289

Net weight 9.2 kg

FUSE

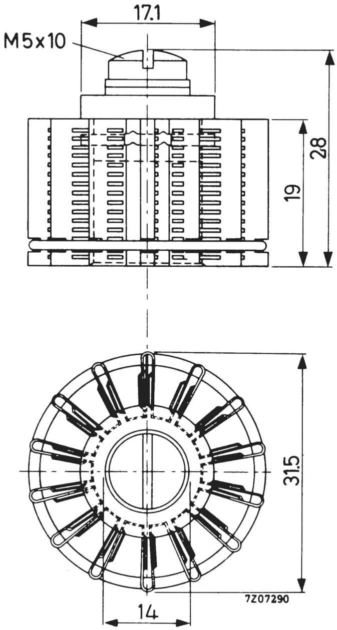

210±2
6
M5
7Z07125
isolating plate
phosphor-bronze stranded wire
vane

PULL SWITCH FOR TUBE CUT-OUT


pulling force
1.5 kg
on-position
out-position
12
7
44
28ø
mounting
holes
4.2
8
40
119
45
14
lead-in
62
42
7Z07126

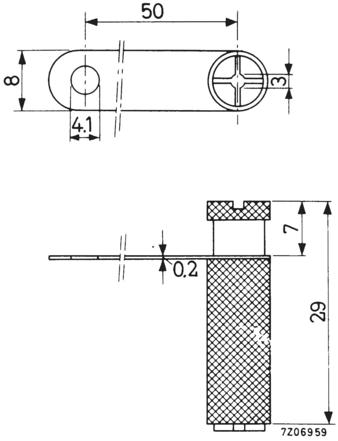
ANODE CONNECTOR

FOR TOP CAPS WITH 14..38 mm ϕ (IEC67-III-1b, type 3)


17.1
M5x10
28
19
31.5
14
7Z07290

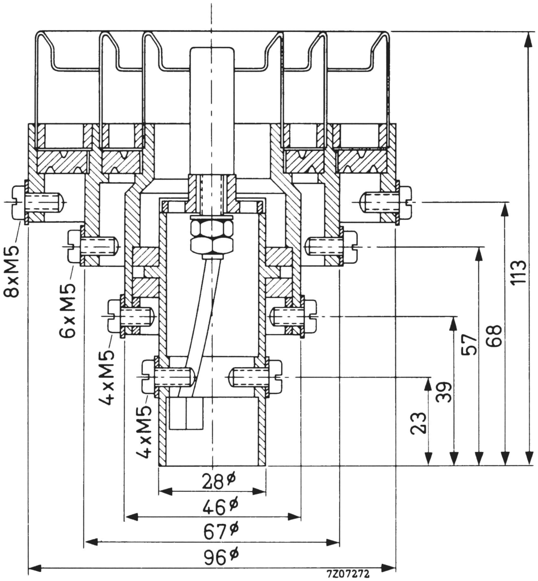
Material: brass, nickel plated

ANODE CONNECTOR


50
8
4.1
3
7
0.2
29
7Z06959

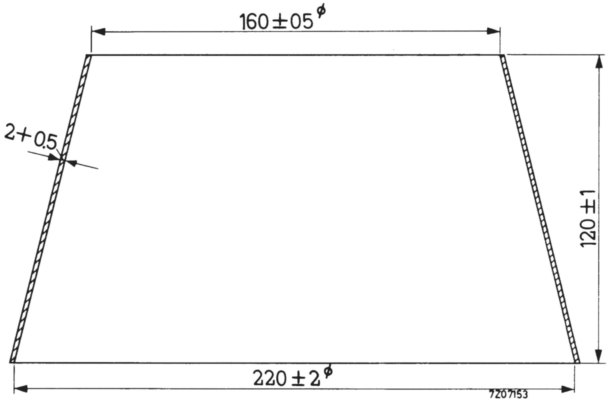
Material: brass, silver plated

TUBE SOCKET

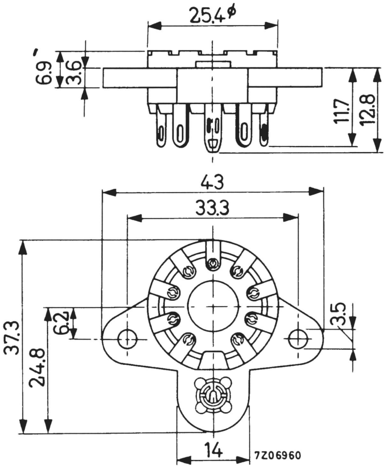

8xM5
6xM5
4xM5
4xM5
113
68
57
39
23
28ø
46ø
67ø
96ø
7Z07272

Material: synthetic resin insulating material
silver plated contacts

CHIMNEY


160±05ø
2+0.5
120±1
220±2ø
7207153

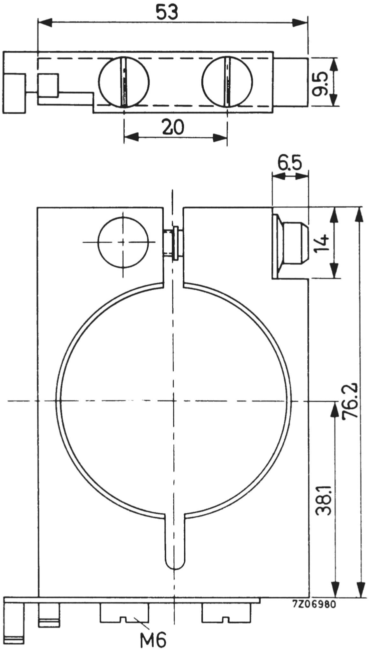
TUBE SOCKET FOR MAGNOVAL BASES


25.4ø
6.9
3.6
11.7
12.8
43
33.3
37.3
24.8
6.2
3.5
14
7Z06960

Material: synthetic resin insulating material
9 silver plated cup-shaped contacts

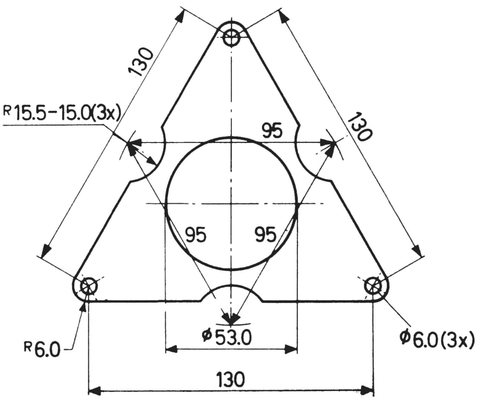
GRID CONNECTOR

→ FOR 48 mm ϕ TERMINALS


53
9.5
20
6.5
14
76.2
38.1
M6
7Z06980

Material: brass, silver plated

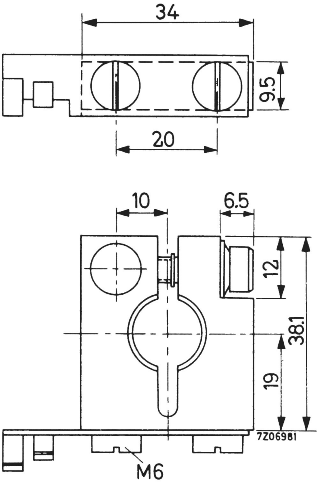
GRID CONNECTOR


130
130
R15.5-15.0(3x)
95
95
95
R6.0
ϕ53.0
ϕ6.0(3x)
130

Material: Brass

FILAMENT CONNECTOR

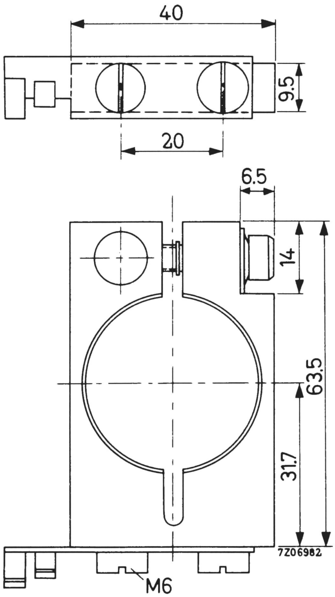
FOR 14.4 mm ϕ TERMINALS


34
9.5
20
10
6.5
12
38.1
19
7Z06981
M6

Material: brass, nickel plated

FILAMENT CONNECTOR

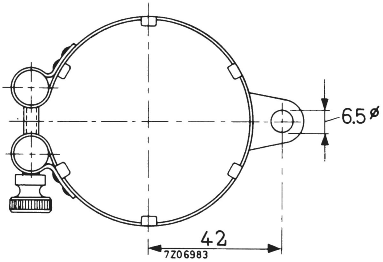
FOR 36 mm ϕ TERMINALS


40
9.5
20
6.5
14
63.5
31.7
7Z06982
M6

Material: brass, nickel plated

GRID CONNECTOR

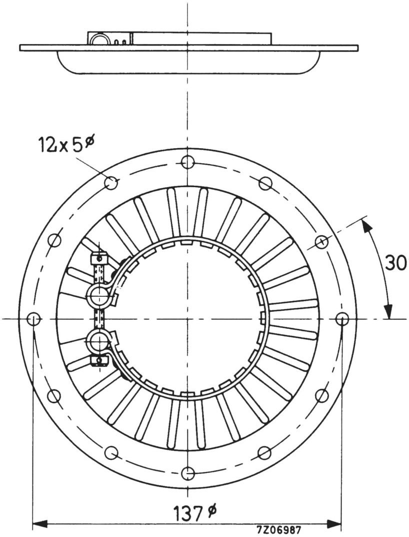
→ FOR 66 mm ϕ TERMINALS


6.5ø
42
7Z06983

Material: brass, silver plated
Net weight: 55 g

GRID CONNECTOR

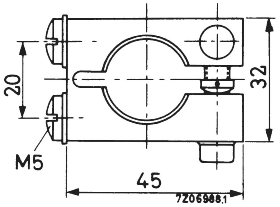
FOR 66 mm ϕ TERMINALS


12x5ø
30°
137ø
7Z06987

Material: brass, silver plated
Net weight: 240 g

FILAMENT CONNECTOR

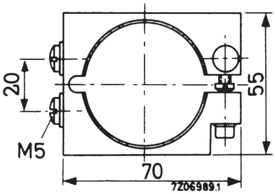
FOR 25.1 mm ϕ TERMINALS


20
32
M5
45
7Z06988.1

Material: brass, nickel plated
Net weight: 140 g

FILAMENT CONNECTOR

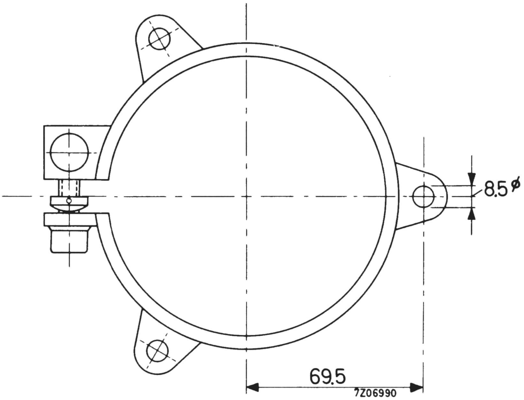
FOR 50 mm ϕ TERMINALS


20
55
M5
70
7Z06989.1

Material: brass, nickel plated
Net weight: 165 g

GRID CONNECTOR

→ FOR 112 mm ϕ TERMINALS

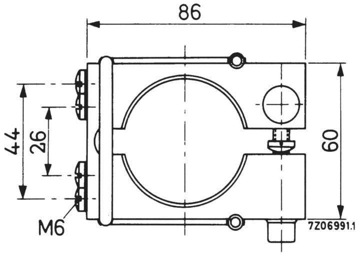

8.5 ϕ
69.5
7Z06990

Material: brass, silver plated
Net weight: 270 g

FILAMENT CONNECTOR

←

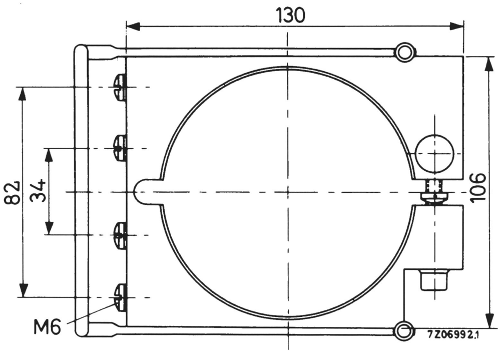
FOR 54 mm ϕ TERMINALS


86
60
44
26
M6
7Z06991.1

Material: brass, nickel plated
Net weight: 710 g

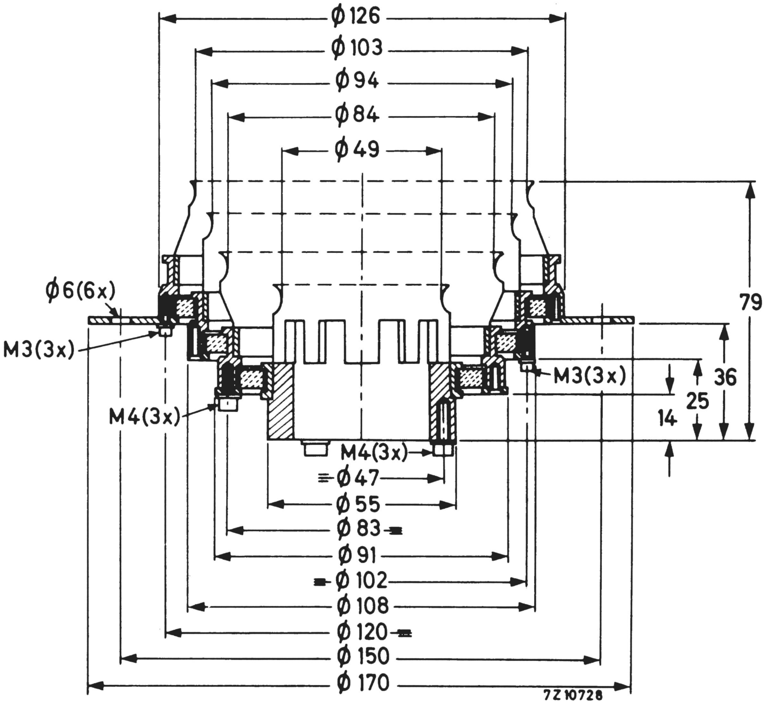
FILAMENT CONNECTOR

FOR 96 mm ϕ TERMINALS


130
82
34
106
M6
7Z06992.1

Material: brass, nickel plated
Net weight: 860 g

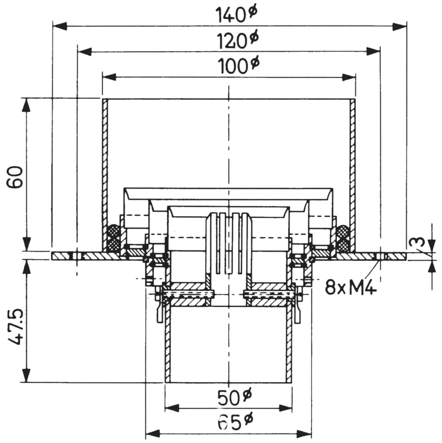
TUBE SOCKET FOR COAXIAL TUBES


ϕ126
ϕ103
ϕ94
ϕ84
ϕ49
ϕ6(6x)
M3(3x)
M3(3x)
79
36
25
14
M4(3x)
M4(3x)
ϕ47
ϕ55
ϕ83
ϕ91
ϕ102
ϕ108
ϕ120
ϕ150
ϕ170
7Z10728

Material: teflon insulating material
silver plated contact springs

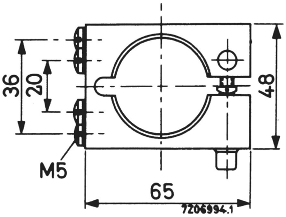
→

TUBE SOCKET FOR COAXIAL TETRODES


140⌀
120⌀
100⌀
60
3
8xM4
47.5
50⌀
65⌀

FILAMENT CONNECTOR

FOR 42 mm ϕ TERMINALS

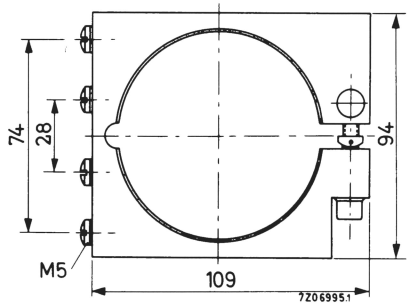

36
20
48
M5
65
7Z06994.1

Material: brass, nickel plated

→

FILAMENT CONNECTOR

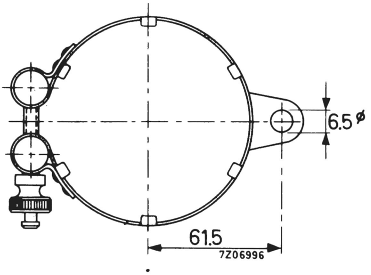
FOR 86 mm ϕ TERMINALS


74
28
94
M5
109
7Z06995.1

Material: brass, nickel plated

GRID CONNECTOR

FOR 105 mm ϕ TERMINALS ←

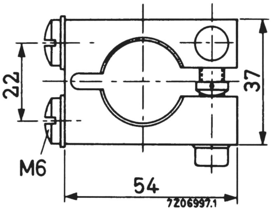

6.5 ø
61.5
7Z06996

Material: brass, silver plated

→

FILAMENT CONNECTOR

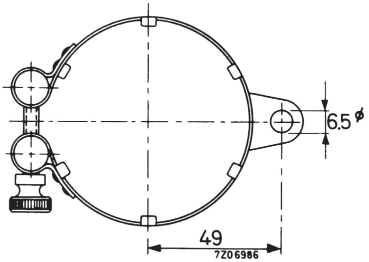
FOR 32 mm ϕ TERMINALS


22
37
M6
54
7Z06997.1

Material: brass, nickel plated
Net weight: 230 g

GRID CONNECTOR

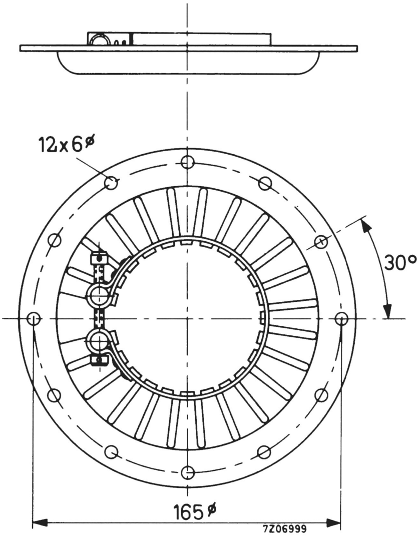
FOR 80 mm ϕ TERMINALS


6.5ϕ
49
7Z06986

Material: brass, silver plated
Net weight: 60 g

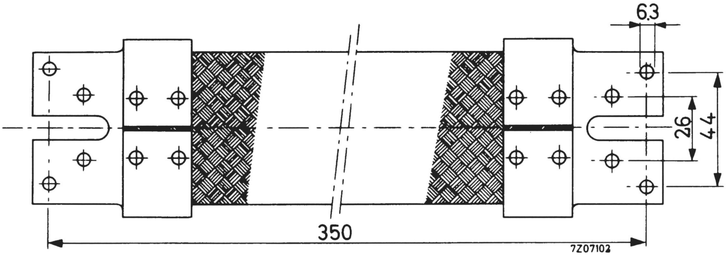
GRID CONNECTOR

FOR 80 mm ϕ TERMINALS


12x6ϕ
30°
165ϕ
7Z06999

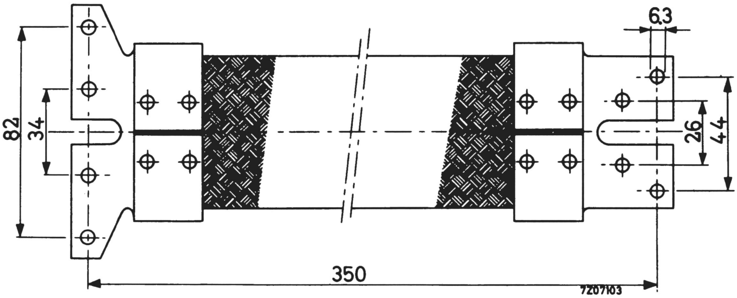
Material: brass, silver plated
Net weight: 310 g

FILAMENT CABLE
TO BE USED WITH 40695


6,3
26
44
350
7Z07102

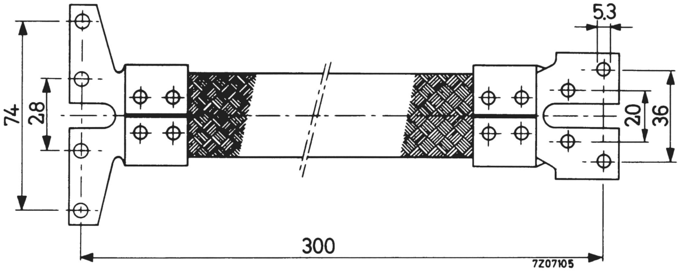
Net weight: 975 g

FILAMENT CABLE
TO BE USED WITH 40696

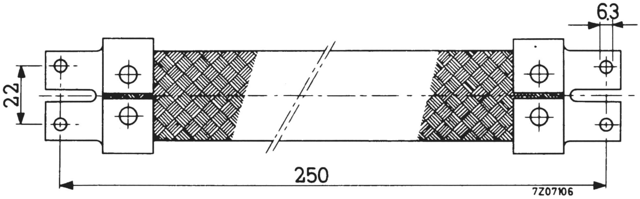

6,3
82
34
26
44
350
7207103

Net weight: 980 g

FILAMENT CABLE
TO BE USED WITH 40706

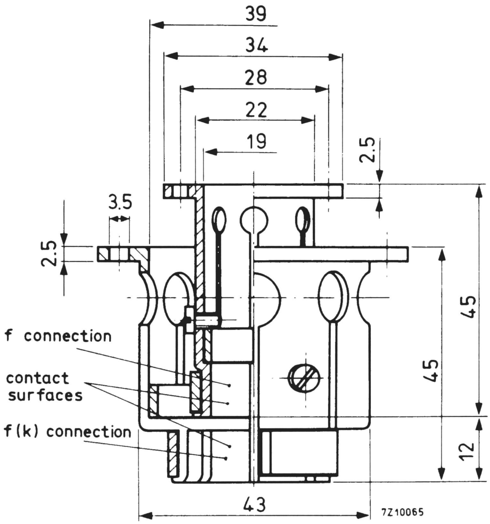

74
28
5.3
20
36
300
7Z07105

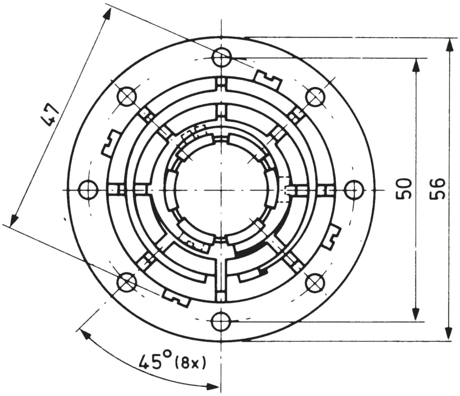
FILAMENT CABLE
TO BE USED WITH 40708 AND 40709


6,3
22
250
7Z07106

Net weight: 215 g

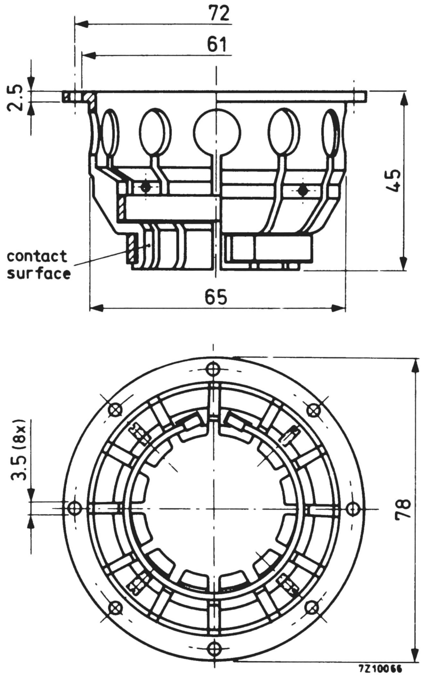
FILAMENT CONNECTOR


39
34
28
22
19
2.5
3.5
2.5
45
45
12
f connection
contact surfaces
f(k) connection
43
7Z10065


47
50
56
45° (8x)

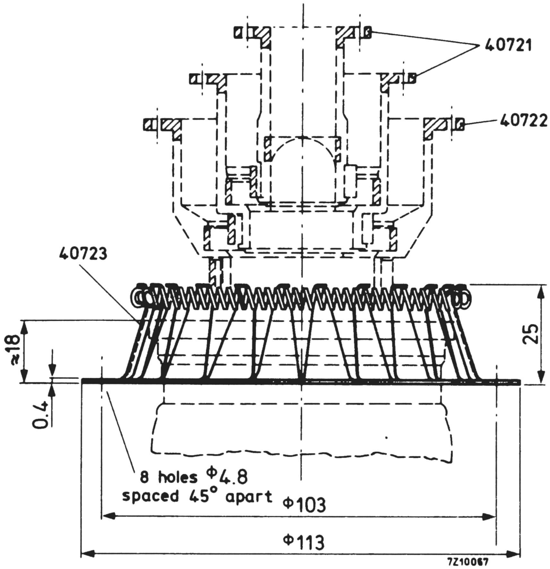
Net weight: approx. 0.2 kg

GRID CONNECTOR


72
61
2.5
45
contact surface
65
3.5 (8x)
78
7Z10066

Net weight: approx. 0.2 kg

SCREEN GRID CONNECTOR

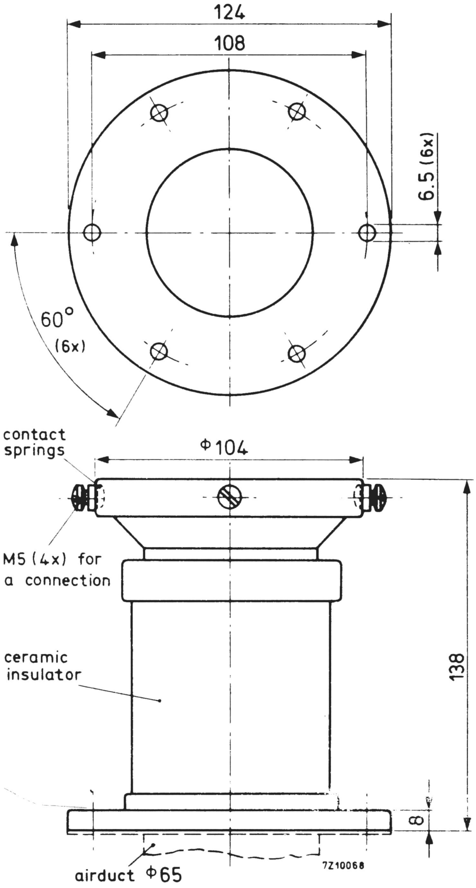

40721
40722
40723
25
≈18
0.4
8 holes Φ4.8
spaced 45° apart
Φ103
Φ113
7Z10067

Net weight: approx. 0.1 kg

Caution

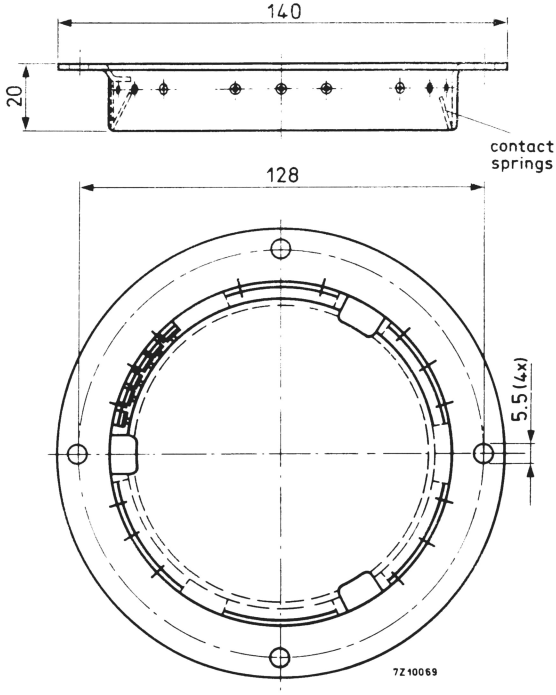
The tube must never be pulled through the spring ring.
So, if it has to be inserted from above, this should be done first, before the screen grid connection is made. Similarly, the tube can only be taken out after the screen grid connector has been removed.

INSULATING PEDESTAL


124
108
6.5 (6x)
60°
(6x)
contact
springs
Φ104
M5 (4x) for
a connection
ceramic
insulator
138
8
airduct Φ65
7Z10068

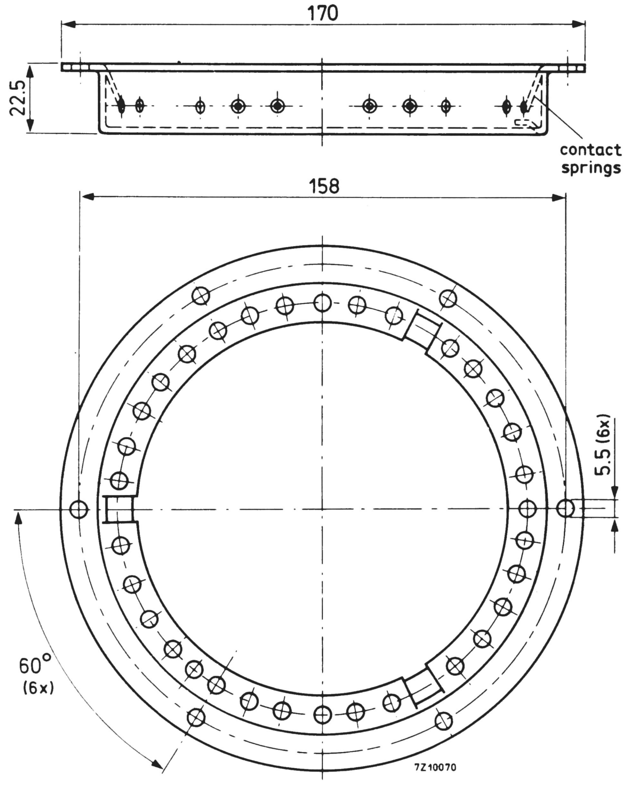
Net weight: approx. 1.3 kg

GRID CONNECTOR


140
20
contact springs
128
5.5 (4x)
7Z10069

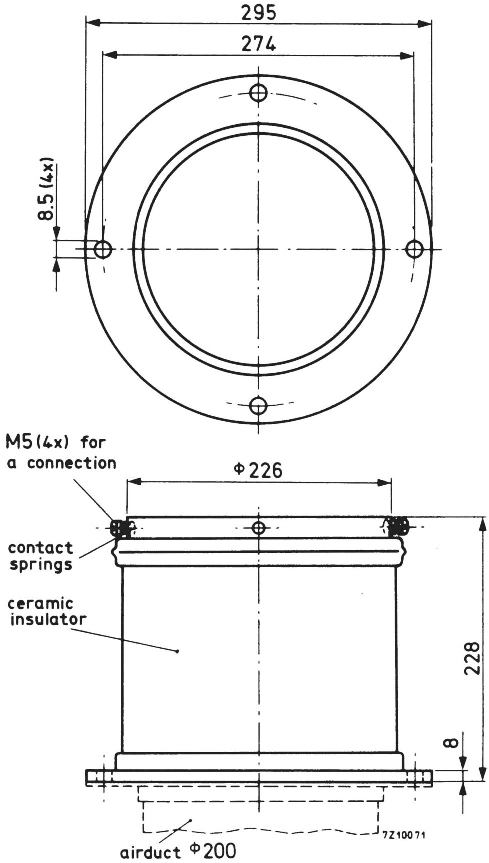
Net weight: approx. 0.14 kg

SCREEN GRID CONNECTOR


170
22.5
contact springs
158
5.5 (6x)
60°
(6x)
7Z10070

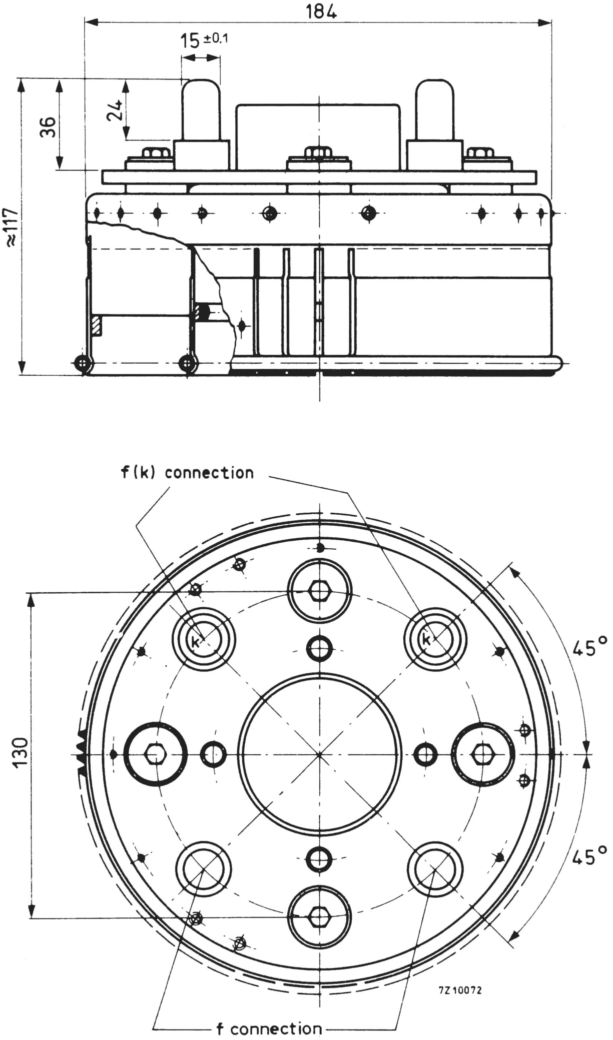
Net weight: approx. 0.2 kg

INSULATING PEDESTAL


295
274
8.5 (4x)
M5 (4x) for
a connection
Φ226
contact
springs
ceramic
insulator
228
8
airduct Φ200
7Z10071

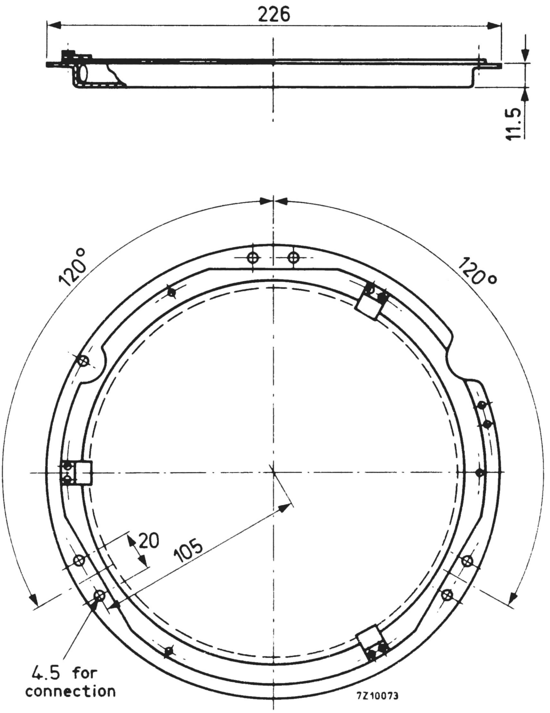
Net weight: approx. 8.2 kg

FILAMENT CONNECTOR


184
15 ±0.1
36
24
≈117
f(k) connection
k
k
45°
45°
130
7Z10072
f connection

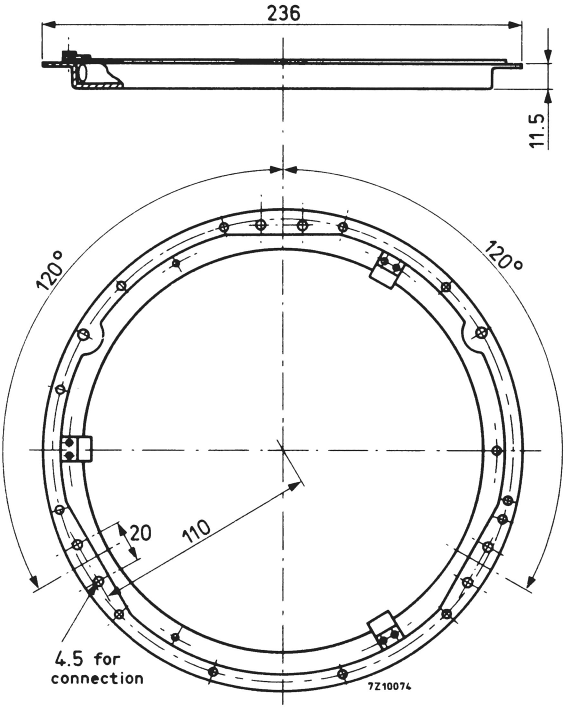
Net weight: approx. 2.5 kg

GRID CONNECTOR


226
11.5
120°
120°
20
105
4.5 for
connection
7Z10073

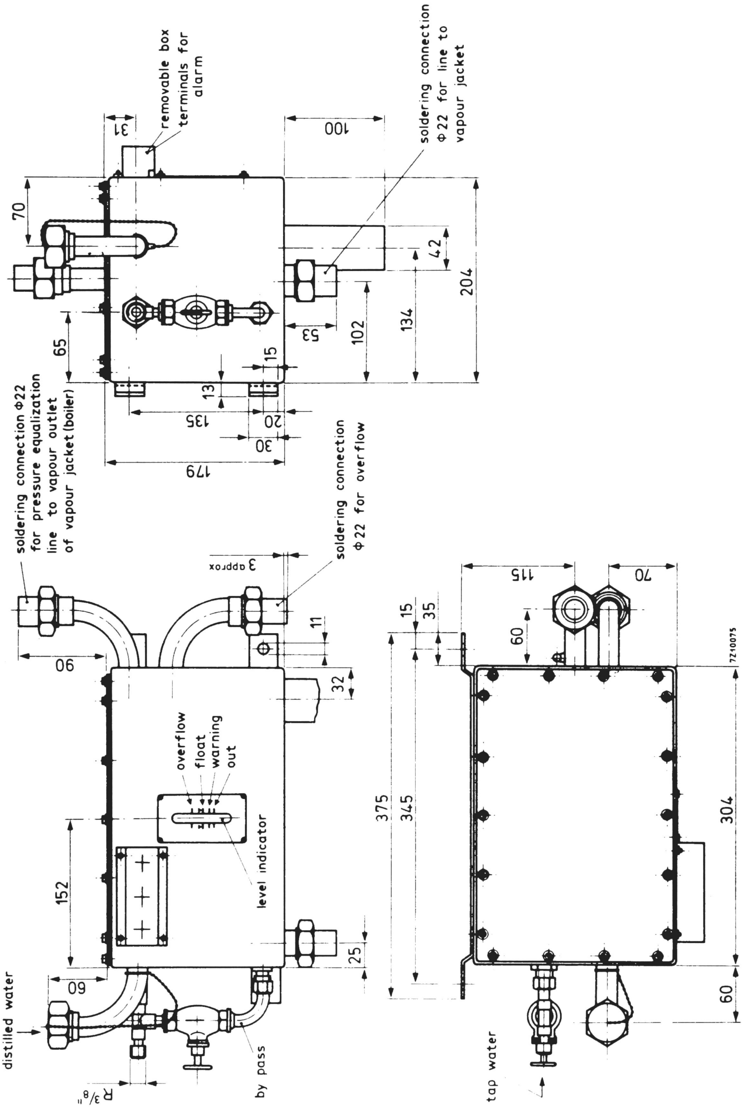
Net weight: approx. 0.35 kg

SCREEN GRID CONNECTOR


236
11.5
120°
120°
20
110
4.5 for
connection
7Z10074

Net weight: approx. 0.4 kg

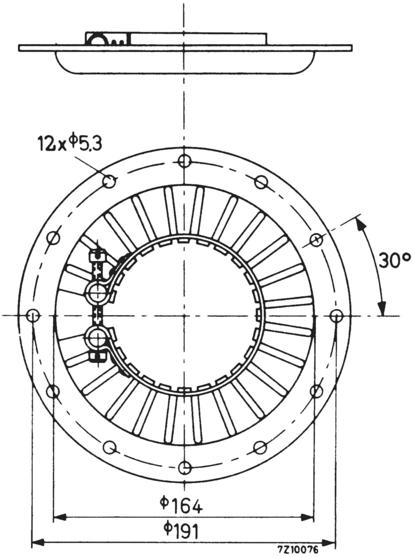
WATER LEVEL CONTROL


removable box
terminals for alarm
soldering connection Φ22 for line to vapour jacket
31
100
70
42
204
134
102
53
65
15
13
20
135
30
179
soldering connection Φ22 for pressure equalization line to vapour outlet of vapour jacket (boiler)
soldering connection Φ22 for overflow
3 approx
90
11
32
overflow
float
warning
out
level indicator
152
25
60
distilled water
R 3/8"
by pass
115
70
15
35
60
375
345
304
60
tap water
7210075

Material: Copper
Net weight: approx. 8.5 kg

GRID CONNECTOR

FOR 105 mm ϕ TERMINALS



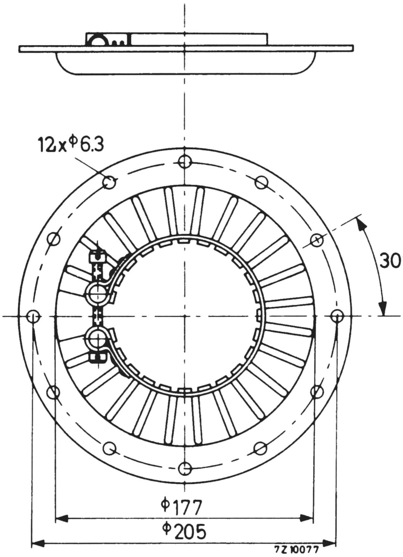
12 x ϕ5.3
30°
ϕ164
ϕ191
7Z10076

Material: brass, silver plated

Net weight: 450 g

GRID CONNECTOR

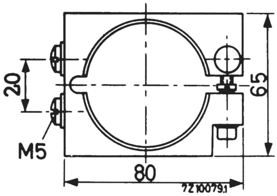
FOR 112 mm ϕ TERMINALS


12xϕ6.3
30°
ϕ177
ϕ205
7Z10077

Material: brass, silver plated
Net weight: 525 g

GRID OR FILAMENT CONNECTOR

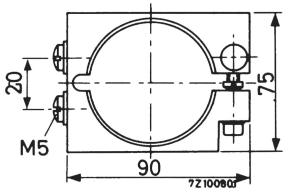
FOR 50 mm ϕ TERMINALS


20
65
M5
80
7Z10079.1

Material: brass, nickel plated

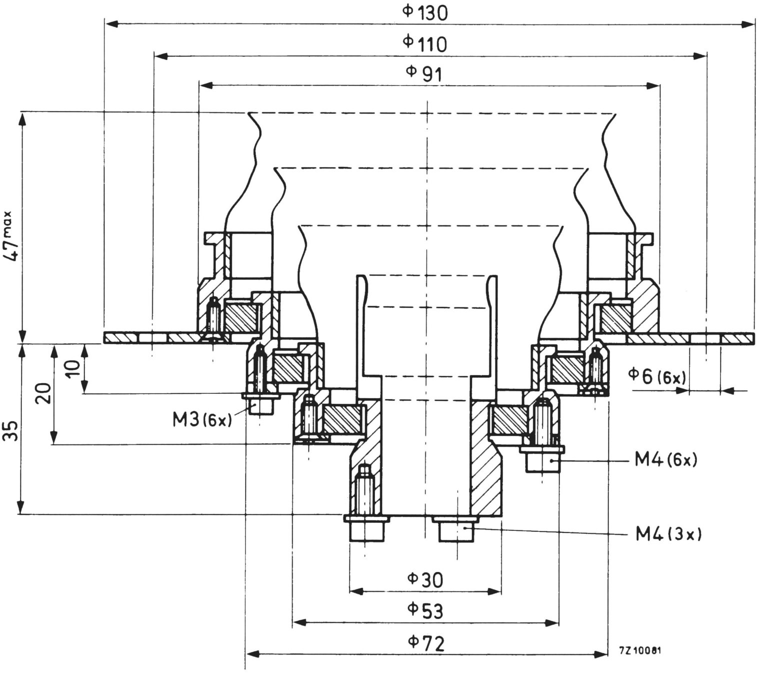
SCREEN GRID CONNECTOR

FOR 70.1 mm ϕ TERMINALS


20
M5
75
90
7Z10080.1

Material: brass, nickel plated

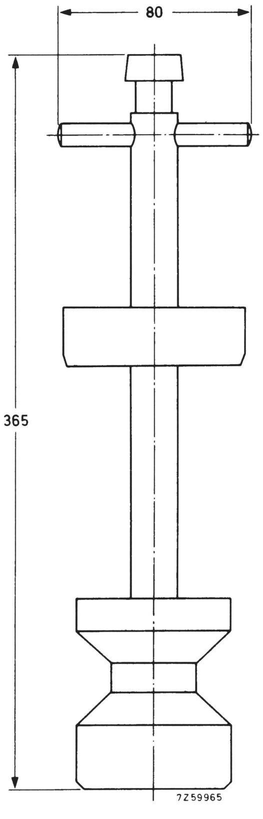
SOCKET


Φ130
Φ110
Φ91
47max
10
20
35
M3 (6x)
Φ6 (6x)
M4 (6x)
M4 (3x)
Φ30
Φ53
Φ72
7Z10081

Material: brass and polytetra fluoroethylene

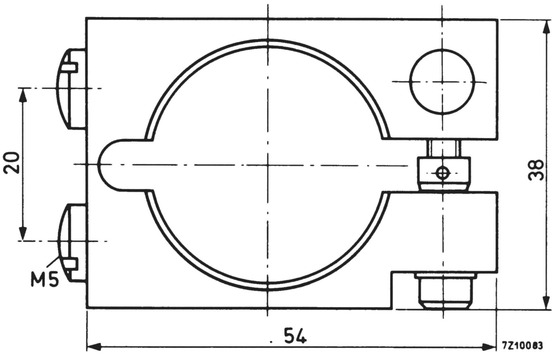
TUBE EXTRACTOR

←


80
365
7Z59965

GRID CONNECTOR

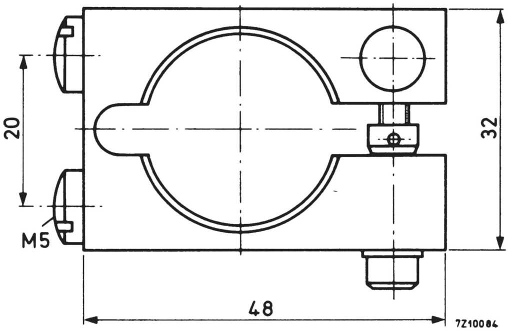
→ FOR 33.5 mm ϕ TERMINALS


20
M5
38
54
7Z10083

Material: brass

FILAMENT/CATHODE CONNECTOR

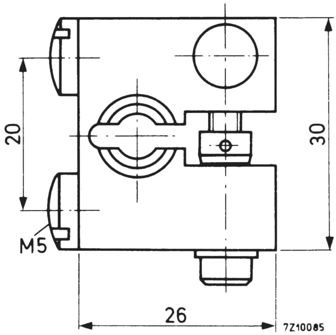
FOR 27 mm ϕ TERMINALS


20
32
M5
48
7Z10084

Material: brass

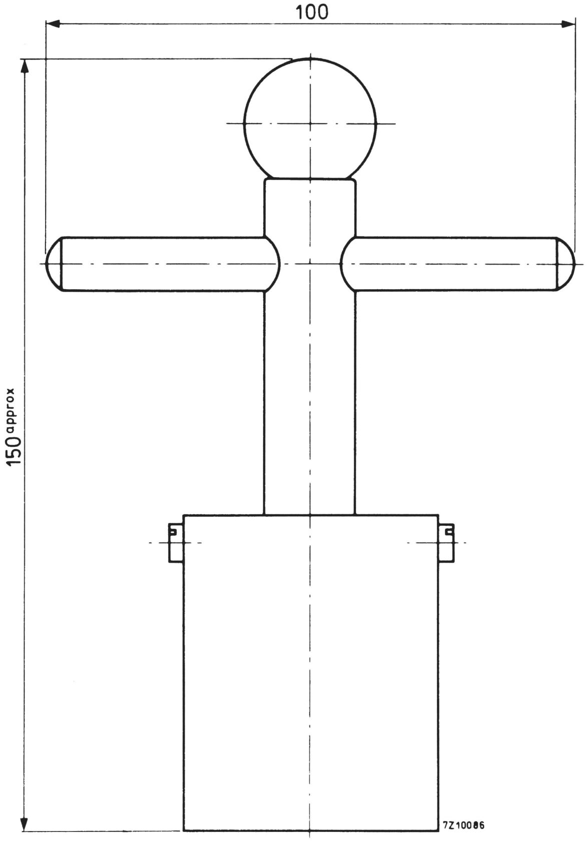
GRID OR FILAMENT CONNECTOR

→ FOR 9 mm ϕ TERMINALS


20
30
M5
26
7Z10085

Material: brass

TUBE EXTRACTOR


100
150 approx
7Z10086

INDEX OF TYPENUMBERS

Type No.	Section
K503	Acc.
K504	Acc.
K506	Acc.
K508	Acc.
K509	Acc.
K713	Acc.
K714	Acc.
K715	Acc.
K717	Acc.
K720	Acc.
K721	Acc.
K722	Acc.
K723	Acc.
K724	Acc.
K726	Acc.
K727	Acc.
K728	Acc.
K729	Acc.
K733	Acc.
K734	Acc.
K735	Acc.
TAL12/10	Tr.T.
TAL12/20	Tr.T.
TAL12/35	Tr.T.
TAW12/10	Tr.T.
TAW12/20	Tr.T.
TAW12/35G	Tr.T.
TB2.5/300	Tr.T.
TB2.5/400	Tr.T.
TB3/750	Tr.T.
TB4/1250	Tr.T.
TB4/1500	Tr.T.
TB5/2500	Tr.T.
TBH6/14	Tr.T.
TBH6/6000	Tr.T.

Type No.	Section
TBH7/8000	Tr.T.
TBH7/9000	Tr.T.
TBH12/25	Tr.T.
TBH12/38	Tr.T.
TBL2/300	Tr.T.
TBL2/400	Tr.T.
TBL2/500	Tr.T.
TBL6/14	Tr.T.
TBL6/20	Tr.T.
TBL6/4000	Tr.T.
TBL6/6000	Tr.T.
TBL7/8000	Tr.T.
TBL7/9000	Tr.T.
TBL12/25	Tr.T.
TBL12/38	Tr.T.
TBL12/40	Tr.T.
TBL12/100	Tr.T.
TBL15/125	Tr.T.
TBW6/14	Tr.T.
TBW6/6000	Tr.T.
TBW7/8000	Tr.T.
TBW7/9000	Tr.T.
TBW12/25	Tr.T.
TBW12/38	Tr.T.
TBW12/100	Tr.T.
TBW15/125	Tr.T.
YD1000	Tr.T.
YD1001	Tr.T.
YD1002	Tr.T.
YD1010	Tr.T.
YD1012	Tr.T.
YD1120	Tr.T.
YD1130	Tr.T.
YD1140	Tr.T.

Acc. = Accessories
Tr.T. = Transmitting tubes, Triodes

Type No.	Section
YD1141	Tr.T.
YD1150	Tr.T.
YD1151	Tr.T.
YD1152	Tr.T.
YD1160	Tr.T.
YD1161	Tr.T.
YD1162	Tr.T.
YD1170	Tr.T.
YD1171	Tr.T.
YD1172	Tr.T.
YD1173	Tr.T.
YD1180	Tr.T.
YD1182	Tr.T.
YD1190	Tr.T.
YD1192	Tr.T.
YD1193	Tr.T.
YD1202	Tr.T.
YD1203	Tr.T.
YD1212	Tr.T.
YD1213	Tr.T.
YD1240	Tr.T.
YD1352S	Tr.T.
5866	See TB2.5/300
5867	See TB3/750
5868	See TB4/1250
5923	See TBW6/6000
5924	See TBL6/6000
6077	See TBW12/100
6078	See TBL12/100
6617	See TBW12/25
6618	See TBL12/25
6960	See TBW7/8000
6961	See TBL7/8000
7004	See TBL2/300
7092	See TB5/2500

Type No.	Section
7753	See TBL6/4000
7804	See TBL6/14
7805	See TBW6/14
7806	See TBL12/38
7807	See TBW12/38
7986	See TB2.5/400
8078	See TB4/1500
8119	See TBL2/400
8120	See TBL2/500
8163	See YD1130
8268	See TBW7/9000
8269	See TBL7/9000
8591	See TBH6/14
8592	See TBH7/8000
8593	See TBH7/9000
8594	See TBH12/38
8610	See TBH6/6000
8666	See YD1170
8667	See YD1171
8668	See YD1172
8680	See YD1212
8728	See YD1150
8729	See YD1151
8730	See YD1152
8731	See YD1160
8732	See YD1161
8733	See YD1162
8734	See YD1173
8735	See YD1182
8736	See YD1192
8752	See YD1202
8801	See YD1180
8867	See YD1352S
40210/02	Acc.
40615	Acc.

Acc. = Accessories
Tr.T. = Transmitting tubes, Triodes

Type No.	Section
40619	Acc.
40622	Acc.
40623	Acc.
40624	Acc.
40626	Acc.
40628	Acc.
40630	Acc.
40634	Acc.
40635	Acc.
40648	Acc.
40649	Acc.
40650	Acc.
40651	Acc.
40652	Acc.
40653	Acc.
40654	Acc.
40662	Acc.
40663	Acc.
40664	Acc.
40665	Acc.
40666	Acc.
40667	Acc.
40670	Acc.
40671	Acc.
40672	Acc.
40675	Acc.
40679	Acc.
40680	Acc.
40681	Acc.
40682	Acc.
40683	Acc.
40685	Acc.
40686	Acc.
40687	Acc.
40688	Acc.

Type No.	Section
40689	Acc.
40690	Acc.
40691	Acc.
40692	Acc.
40693	Acc.
40694	Acc.
40695	Acc.
40696	Acc.
40699	Acc.
40704	Acc.
40705	Acc.
40706	Acc.
40707	Acc.
40708	Acc.
40709	Acc.
40710	Acc.
40711	Acc.
40712	Acc.
40715	Acc.
40716	Acc.
40717	Acc.
40718	Acc.
40719	Acc.
40720	Acc.
40721	Acc.
40722	Acc.
40723	Acc.
40724	Acc.
40727	Acc.
40728	Acc.
40729	Acc.
40732	Acc.
40733	Acc.
40734	Acc.
40735	Acc.

Acc. = Accessories

Type No.	Section
40736	Acc.
40737	Acc.
40740	Acc.
40741	Acc.
40742	Acc.
40750	Acc.
40751	Acc.
40752	Acc.
40753	Acc.
40754	Acc.

Type No.	Section

Acc. = Accessories

General section

Transmitting tubes for communication and Tubes for R.F. heating

TRIODES

Associated accessories

Printed in The Netherlands

9399 241 15501